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Need of an Economic Approach to Distribution

THERE should be a greater degree of standardization in distribution, and the weapon by which to get it is the use of economic studies of existing systems. During the past few years a great deal of theoretical work has been done on distribution, many properties have revamped their distribution systems, several new distribution systems have been installed, and many local economic studies have been made.

Much of the capital expenditure for the next few years will occur in distribution. Distribution ties up with increased service in the homes, with safety codes and with co-operative relations in joint use and inductive co-ordination. There is need to get economic and service data which will differentiate the types of distribution systems and to prepare a program of distribution development for utility properties. The size, type and location of substations, the economic advantages of the different voltages and phases, the best method of procedure in establishing a network, the type of network and a host of other items in distribution are too largely local and too largely based on opinion, theory and tradition. If service values and economic merits are adopted as deciding factors, there is every reason to believe that distribution can be made a very tangible project and one that can be standardized to the advantage of the industry.

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Money Available for Expansion and Growth

NORMAL expenditures of the electric light and power companies of the country for extensions, improvements and new generating facilities will call for approximately $800,000,000 in 1930. This is a conservative estimate, based on past performances and practices. In view of the recent stock market slump, however, the question arises, "How is the money to be raised?" That it will be forthcoming there is no doubt, but through what channels remains to be determined and probably will not be settled until confidence is restored and conditions in the money market become more stabilized.

Bonds unquestionably will be in greater demand next year than they have been for some time, and by March a good bond market should be established. Inasmuch as a large part of public utility financing during the last two years has been effected through the sale of stock, electric public utilities should not experience much difficulty in successfully floating bond issues with so much junior security backing. And since the preferred stock of the utilities has not lost favor with investors, a large block of new money is also procurable through this means. Older companies with regular dividend-paying capital stock will, of course, still raise funds through stock issues; but it is natural to expect little demand for the non-dividend-paying stocks of other utilities.

Thus the electric light and power industry need have no misgivings about funds for growth and development. It may be necessary to issue more bonds than stock to obtain the money, and with a favorable bond market money is very apt to be plentiful and cheap. Naturally, the utilities would rather have partners than creditors, but the demands for electric service will not wait on Peter or Paul. Service costs money, and the money must and will be spent—and a dollar is a dollar no matter what the collateral may be on which it is raised. What really matters is that the money can and will be raised.

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Is the Public Tiring of Utility Probes?

TO USE a bit of army slang, the opening hearing at Boston last week in the investigation ordered by the Legislature of the state into public utilities was a "dud." The committee faced enough empty chairs to dishearten even a crusader; popular interest was flaccid in the extreme, and at the end of an hour adjournment was declared without a single company representative being asked to open his mouth. The Public Franchise League of Boston asked the committee to have questionnaire answers, stockholders' lists and various regulatory material printed for general distribution. One speaker assailed the reproduction-cost theory of rate making in a brief speech which also emphasized the need of keeping utility credit high enough to attract a steady flow of capital into the industry. An agitator made an attack upon the power industry as the embodiment of the cloven hoof, and the curtain fell on Act One.

The committee is studying replies to a long questionnaire sent by it to the utilities some time ago and will of course continue hearings at a later date if it deems them worth while. As in the past, the power companies of the Bay State are ready to meet this inquiry frankly.

The subject matter of this inquiry is not yet "front-page copy" for the newspapers. The attitude of the public toward this investigation signifies a measure of indifference or weariness which is hopeful, especially when considered in connection with recent assaults on companies in this particular state. The inquiry may go on and perform useful service, but may it not be true that public sentiment has begun to realize that many of these investigations furnish more political capital than they yield in public benefit? The ancient proverb that one swallow does not make a summer applies to nation-wide conclusions from one hearing even in such a redoubtable state as Massachusetts, but the pulse reading, to change the figure, is a favorable symptom.

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Develop the Human Power

THERE is more to the utility business than finance and the assembly of stations, lines and customers. Man power must be had, and it must be efficient, able and inspired to its best efforts at all times. In the consolidation of properties the fact is often forgotten that a local property has been successful because of the men who conducted it. They built the system, sold the energy and developed the good will. They put all their initiative and vigor into their tasks.

When consolidations occur men on local properties often feel that their feet have been swept from under them. They become hesitant and nervous and are speechless when they should be outspoken. There develops a fear complex lest they lose their situations, and often there is an attempt to progress through politics rather than merit. All this uneasiness and inefficiency result because too many holding-company executives have dealt largely with finance and top organization and have not seen fit to bring into their counsels the men of the operating properties.

Consolidated property managements should consult local property men about all major system developments and instill all possible initiative into the local managements. It should be impossible to plan a major property construction at holding-company headquarters without consultation with a local property; yet this is being done, and very frequently local property men are too cowed or too little interested to protest against the plan or to present to headquarters a plan showing what should be done. Again, when hard times come or appear to be coming, too frequently the orders go forth to reduce the number of employees on local properties. This means the discharge of high-grade and veteran men if any appreciable reduction is to be made in the payroll. It means the loss of valuable men trained over a period of years, and it adds new impetus to the unrest of the employees who remain.

It is as true today as in the past that men in direct control of equipment and service must be the mainsprings of utility progress. It is their intelligence and initiative applied to the conditions they meet that bring about improvements. Managements of consolidated properties should bear this in mind.

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Lighting—Other than Electric

IN THIS jubilee year of electric light, when every paper and every magazine and many books are filled with well-earned tributes to Thomas Edison and to the great industry of electric light, it might be well to be reminded that other fields of lighting have not been neglected, but have recently been subjected to more serious study than ever in the past. There is natural daylight, for instance. The *Transactions* of the Illuminating Engineering Society of the last few years contain a wealth of information on window and skylight design and other problems of natural daylight, based on more thoroughgoing theoretical and practical investigations than were ever attempted before. All these data and more will no doubt soon be made available to the busy architect in summarized, systematized and condensed form and will serve a very useful purpose.

The Illuminating Engineering Society is also slowly accumulating a great amount of information on the influence of the various kinds of light rays on the human body, as was evidenced by the papers and discussions in the recent Philadelphia convention of the society. These phases of activity of the society, pursued modestly but thoroughly, deserve the praise and appreciation not only of the engineering profession, but of the public at large.

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Chlorination Aids Condenser Operation

SOURCES of circulating water for steam power stations are contaminated in nearly all metropolitan areas. This condition makes it necessary to clean condensers very frequently and interferes seriously both with continuity of operation and with the amount of vacuum that can be maintained. In some instances it is necessary to clean condensers once a week, and this involves considerable trouble and expense.

There is little excuse for these conditions to exist in circulating-water sources. Sewage disposal is a well-standardized art and laws should be enforced against contamination. The health of the public should be safeguarded. But laws are not adequate at present

and conditions are becoming more serious. Utility companies must provide a remedy, and the most promising approach to a solution of the problem is the use of chlorine.

Algæ form in the condenser, and mud and silt deposits on the algæ cause insulation of the tubes and consequently a lower vacuum. Experiments on several properties indicate that frequent doses of chlorine in the circulating water before it enters the condenser will prevent the growth of the algæ. It is also possible to have continuous chlorination of the water, but this appears to be less economical than the use of frequent injections of chlorine. The cost of chlorination is very nominal when balanced against the costs brought about by contaminated water, and there is every prospect that the present experimental installations will in large measure solve the condenser cleaning problem.

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The Wholesaler's House Is in Order

HAND-TO-MOUTH buying a few years ago was rated a hardship by the wholesalers of the electrical industry. It was changing the very nature of their business, upsetting their traditions and putting an end to the good old times when a jobber dealt in large-volume shipments and a retailer carried a stock sufficient for his operations, with periodic buying. Last week, at the winter convention of the National Electrical Wholesalers' Association in Cleveland, there was general congratulation that the "good old days" were gone. For the jobbing industry had checked up on the probable consequences of a possible business setback following the disturbing spectacle of Wall Street's demoralization and found that its affairs were relatively steady and secure.

In 1921 the general depression in business caught the electrical manufacturer, wholesaler and dealer with inflated inventories. These excessive stocks brought embarrassment both because they tied up money needed to meet immediate stress and because, with the sudden tapering off of business, nobody needed to buy. And a camel living off its hump is not happy.

The present situation is not comparable, because business and industry are thriving. The sentiment expressed was that any reaction that might come from the recent avalanche in security prices would be due to the temporary curtailing of personal spending and would affect primarily luxury lines It is expected that general business will be quieter for a few months. To meet this condition distributors of electrical materials are in the best possible condition. There are only moderate stocks in warehouses and on dealers' shelves. Purchasing cannot be interrupted to any large extent and the general tone of the electrical trade should be wholesome.

The only difficult factor in the situation is radio, where production programs have been too large and selling has been forced. Radio is a luxury line, and attention of both wholesaler and retailer must be turned to marketing this merchandise. Losses will be taken and credits must be carefully watched. It was a general source of gratification, however, that the wholesaler's house is in order and that his mind is free to concentrate upon the problem. The flavor of the convention was distinctly cheerful.

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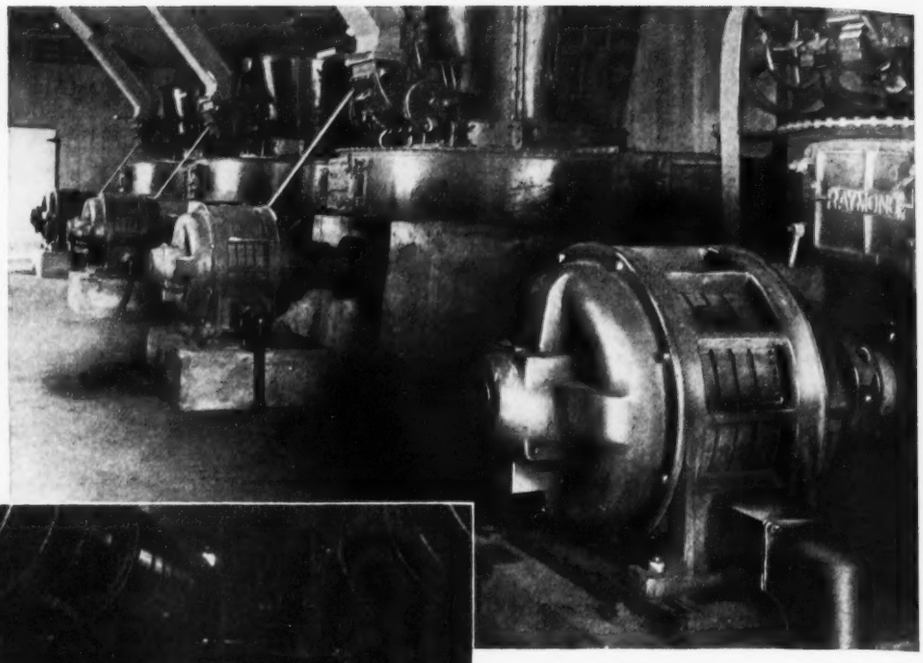
Activity in Dielectric Research

ENGINEERING is essentially a practical profession, and usually its tools and materials and their limitations are well understood. In the older civil and mechanical branches failures of structures or machines are vast. In the electrical field structural failures are equally vast, but fortunately circuit and insulation failures are less so, although certainly far from being all that is desired of them. The ever-present urge to higher voltages is held in check only by the problem of the requisite insulation. As a consequence recent years have seen a rapidly growing interest in the experimental study of insulation, methods of improving it and the search for better materials. Manufacturers through long experience and continuous trial have thrown much light on the precautions necessary in the selection and in the preparation of available materials, and they have a fine record and a remarkably fine offering for every requirement. But this has not satisfied the demands of new enterprise.

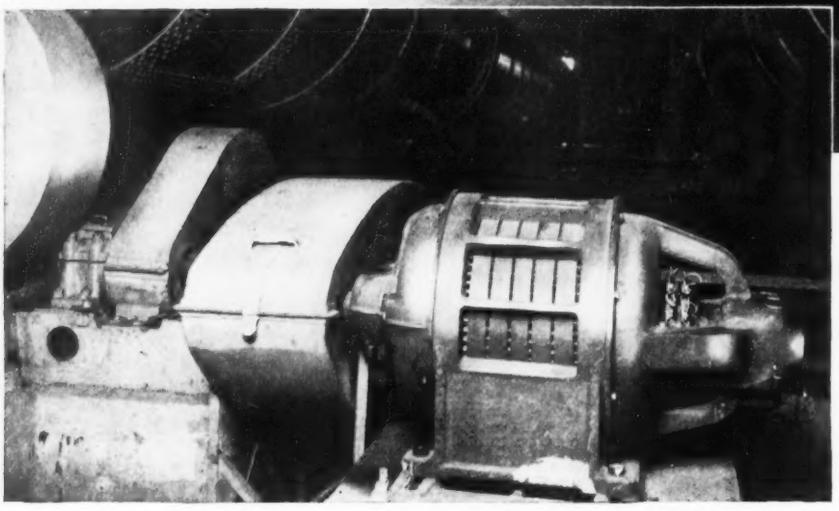
Thus the realization has been spreading that a deeper knowledge of the fundamental properties of dielectrics and the causes underlying these properties is needed. In short, the importance of scientific research in its best sense, as applied to dielectric materials, is now clearly recognized. Manufacturers, public utilities, research foundations and universities are all participating in a mounting wave of interest in this complex problem which promises so much of scientific and practical value.

Much of this activity is heading up under the leadership of the committee on electrical insulation of the National Research Council, of whose annual meeting at the Massachusetts Institute of Technology last week we give an account in another column. This meeting and a similar one at Johns Hopkins last year have shown that insulation engineers, physicists and chemists were only awaiting the summons of such an authoritative body, devoted especially to the stimulation of research, to gather the reports and exchange the experiences which mean so much for the advance of any art. As will be seen from our report, the meeting referred to was on a very high plane. Judging from the discussion by a hundred or more engineers and scientists in attendance, it appears safe to conclude that if insulation does not keep ahead of the demands for higher voltage, it will certainly not lag any farther behind than the limits imposed by old Mother Nature.

Cement Industry Electrified



Four 60-hp. motors driving coal mills for kiln feed. Synchronous motors or wound-rotor induction motors are used



A wound-rotor induction motor kiln drive using secondary resistance and remote control

IN 1928 the United States produced 176,000,000 bbl. of cement at an energy expenditure of from 12 to 18 kw.-hr. per barrel. Plants are located in all sections of the country and the industry has been modernized by a widespread use of electric power. It affords a spendid example of an industrial load of high power factor, high load factor and large energy consumption.

Electric shovel loading cars in a cement quarry. It is equipped with a synchronous motor, three d.-c. generators, exciter set and three operating d.-c. motors

Time Lag of Breakdown

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Material and Process Engineers
Westinghouse Electric & Manufacturing Company

TO PREDICT and control flashover of insulation, wherever it may be, requires definite knowledge of the characteristics of surges and the time lag of breakdown. But considerable confusion has arisen because of lack of suitable definitions and accepted methods of determining time lag values.

The authors of this article attempt to clarify the situation by discussing the factors that affect time lag, methods of measuring and practical considerations. They also compare results of two test methods, discuss impulse ratio, present tests on time lag of insulators and indicate how to apply the results.

THE 60-cycle breakdown or flashover voltage of air insulation is easily determined with satisfactory accuracy. However, a higher voltage can be applied to the insulation provided the rate of application is high compared to a 60-cycle wave. In other words, there is a definite time lag of breakdown for the rapidly applied voltage or surge. Torok and Ramberg[1] have indicated that the breakdown process does not start until the 60-cycle breakdown value has been reached. Also, when the streamer growth is complete, breakdown is inevitable and the voltage drops abruptly. Consequently, it seems logical to define time lag as the time between the rise of voltage above the 60-cycle crest breakdown value and the abrupt drop in voltage when breakdown occurs. This usually corresponds to the time during which the voltage exceeds the 60-cycle flashover value.

Time-lag values vary with different apparatus and depend upon the applied voltage and upon the electrostatic field distribution. Comparisons are made difficult and discrepancies, particularly at the shorter time lags, result from variations in the definitions of time lag and of breakdown time. This condition follows from the different reference points for the start of the breakdown process and from the different types of waves used by various investigators.

LABORATORY METHODS

There are two general methods of applying surge voltages to insulation in time lag tests: (1) The magnitude of a rectangular or abrupt front wave with a flat top may be varied; (2) the rate of rise of voltage or the steepness of the front may be varied.

Abrupt Waves—Wade and Smith[2] have stated that the most desirable, although the most difficult, method is to impress a rectangular wave and hold the voltage constant until flashover occurs, as shown in Fig. 1 (A). The different time-lag values are obtained by changing the applied voltage only. The results are independent of wave form and complicated wave form specifications are eliminated. The minimum breakdown time is indicated, since a more slowly rising wave naturally requires a longer time to produce flashover. This method gives what might be termed absolute values of time lag, since all other variables are eliminated when the voltage is kept constant for a given application.

Variable Wave Front.—In this case the breakdown takes place on the front of a wave which rises at a known rate, as illustrated in Fig. 1 (B). When using a value from a breakdown curve obtained in this way it is necessary to specify the rate of rise[1] of voltage which corresponds to the point considered. Time usually is taken from the start of the voltage wave. Hence, time lag is not shown directly and must be computed from the breakdown curve.

Although the wave form may be varied readily with comparatively low-voltage surge generators, the physical difficulties are great at high voltages. Furthermore, reductions and variations in the wave energy result. A wave which rises to 2,000 kv. in 0.75 microsecond is readily attainable, and the voltage may be maintained above 75 per cent of the maximum for 25 microseconds by using a large capacity surge generator and a high discharge resistance. This approaches the ideal rectangular wave sufficiently for tests on apparatus. The modifications introduced by inability to produce a true rectangular wave are illustrated in Fig. 2 by the divergence from the rectangular waves indicated by the dotted lines. By measuring time from the point at which the voltage exceeds the 60-cycle breakdown value most of the error introduced by the finite rate of rise of voltage is eliminated. In this way a time-lag curve may be obtained by taking oscillograms of a series of applications at different voltages. No adjustments of the circuit constants are necessary.

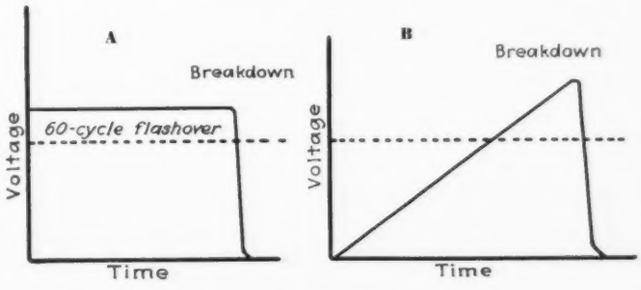


Fig. 1—Types of Waves Used in Time-Lag Tests

(A) Flashover with a rectangular voltage wave.
(B) Flashover on the front of the wave

[1] *Torok and Ramberg, "Impulse Flashover of Insulators," A.I.E.E., Vol. 48, January, 1929.*
[2] *Wade and Smith, "Time Lag of Insulators," "Electrical World," August 18, 1928.*

When flashover occurs on the front of a wave the breakdown point often is not sharply defined and analysis is difficult. The ionization of air is a complicated process and the changing rates of rise of voltage introduce unknown factors. Hence, results obtained by this method are not valid for or even directly applicable to other conditions.

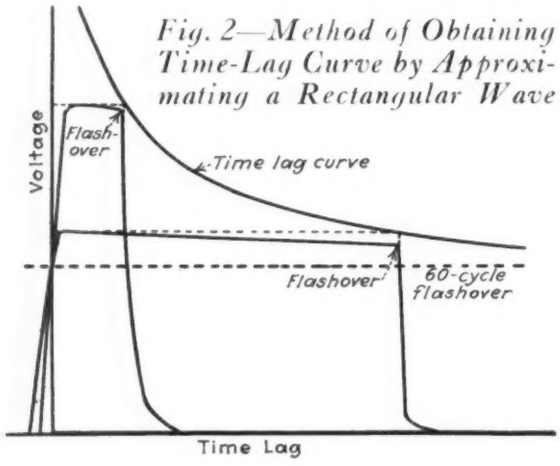


Fig. 2—Method of Obtaining Time-Lag Curve by Approximating a Rectangular Wave

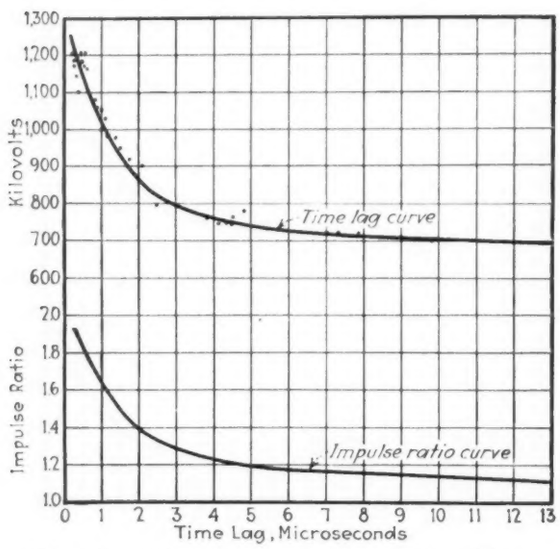


Fig. 3—Time-Lag and Impulse-Ratio Curves of Seven Dry Suspension Units

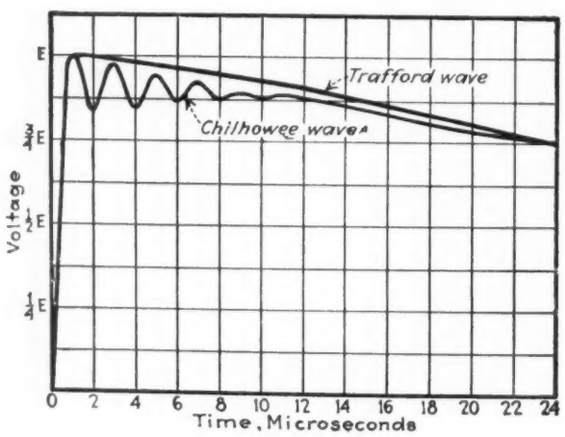


Fig. 4—Comparison of the Laboratory and Actual Lightning Waves

Tamm[3] has investigated methods of determining time-lag values rather thoroughly. For his tests on short gaps with different electrodes a steep-front flat-top wave was adopted. Time was measured, however, from the start of the voltage wave, because the time at which the

[3]*Tamm, "Archiv fur Electrotechnik," XIX, 1928.*

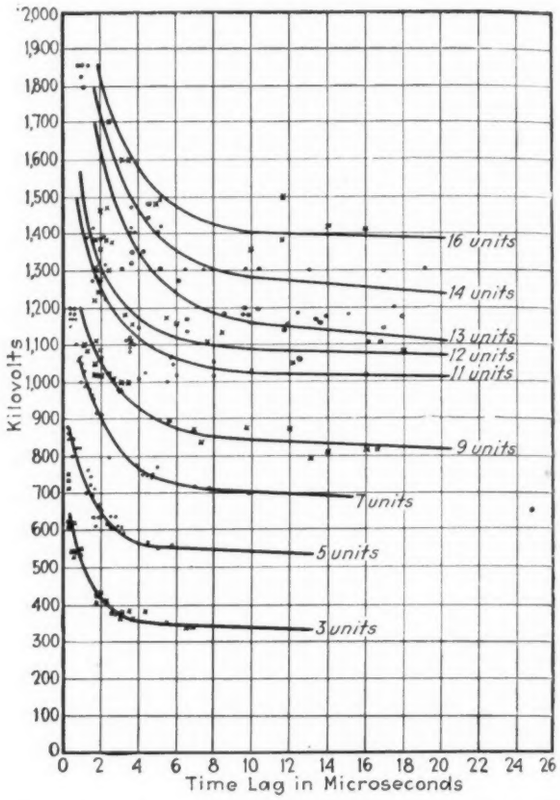


Fig. 5—Experimental Time-Lag Curves on Dry Suspension Insulators

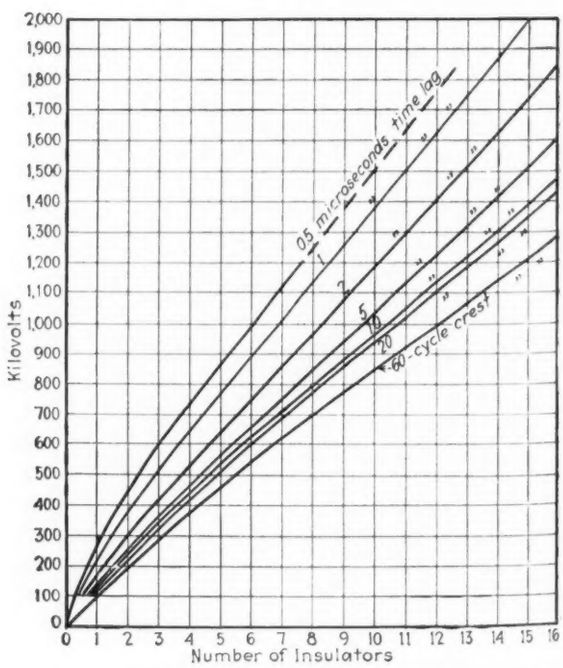


Fig. 6—Average Time-Lag Curves on Dry Suspension Insulators

voltage reached a constant value is not sharply defined. As previously mentioned, this can be avoided by computing time lag from the crossing of the 60-cycle breakdown value.

Comparison of Results

The curves obtained by the two methods are similar in appearance. Obviously, they approach the same limits, since with steep wave fronts or high overvoltages breakdown will occur on the front of the wave and with slow rates of rise or low overvoltages the 60-cycle flashover

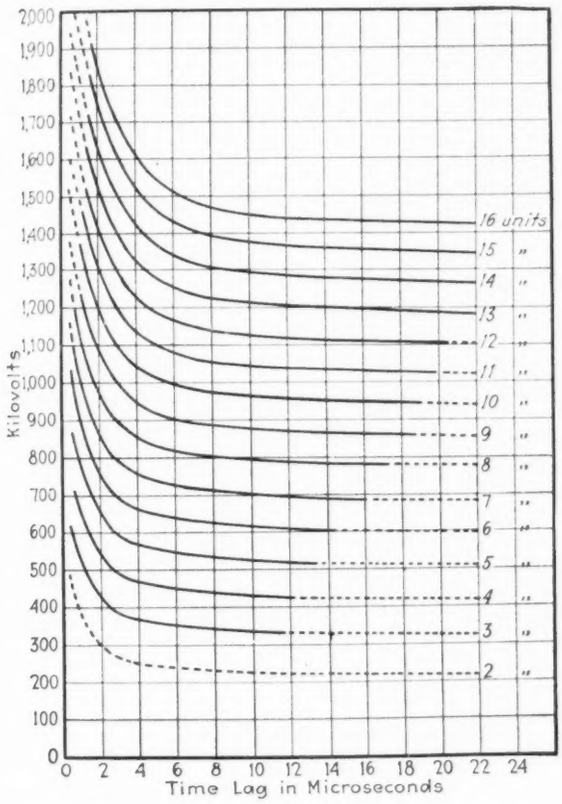


Fig. 7—Average Time-Lag Curves on Dry Suspension Insulators
Diameter 10 in., spacing 5¾ in.

value is approached. Between these limits the breakdown curve indicates the highest overvoltage that can be impressed on the insulation or transmitted as a chopped wave, for the different rates of rise. This information is useful for determining the voltage to which station apparatus may be subjected.

The time-lag curve indicates the minimum time to flashover for a given voltage, and this information is particularly valuable for the rationalization of insulation. Thus, if the time-lag curves of several pieces of apparatus are available the flashover performance with the apparatus connected as in service can be determined and the design engineer can grade the insulation to give the most satisfactory operation.

Only very limited data on the range of wave forms actually produced by lightning on transmission lines are available and the performance of modern station apparatus, particularly when protected by lightning arresters, somewhat lessens the importance of chopped waves. For the above reasons an abrupt-front flat-top wave has been used in all recent time-lag tests at Trafford. In analyz-

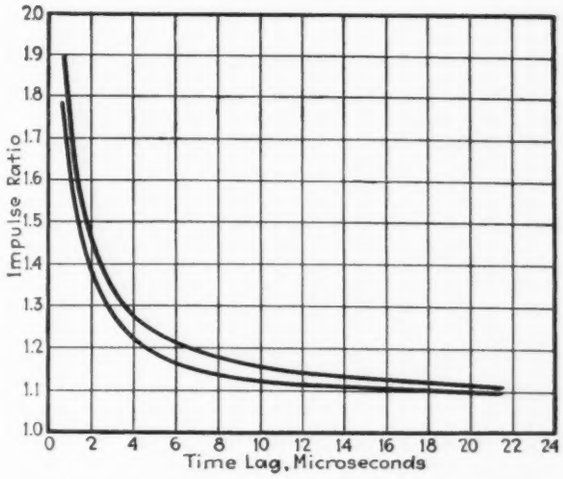


Fig. 8—Impulse Ratio Boundaries of Two to Sixteen Dry Suspension Insulators

ing the records the maximum voltage reached is plotted against the time lag, as in Fig. 3. The conditions discussed above must always be considered when comparing the work of different laboratories, which makes the standardization of laboratory methods extremely desirable.

Impulse Ratio Not a Single Value

The impulse ratio[4] has been loosely defined as the ratio of the surge flashover voltage to the 60-cycle crest flashover voltage. Actually, impulse ratio is represented

[4] *Peek, "Lightning," A.I.E.E., Vol. 48, April, 1929.*

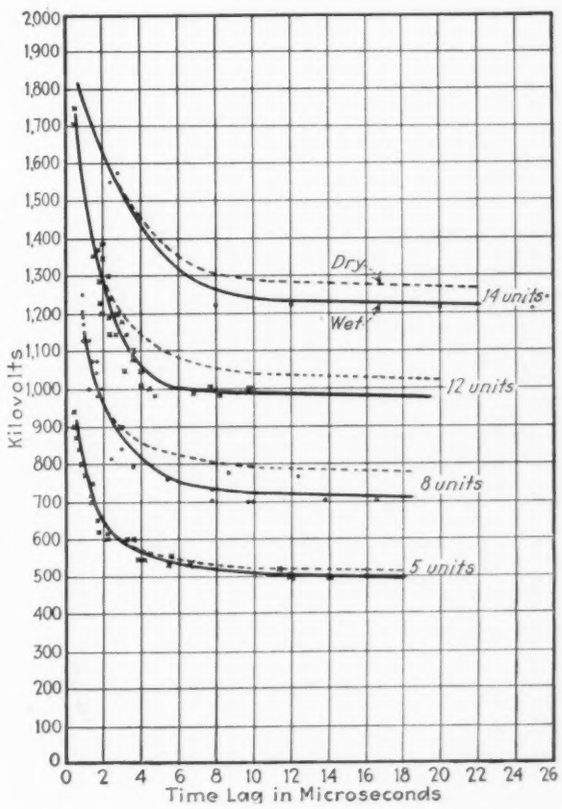


Fig. 9—Experimental Time-Lag Curves of Wet Suspension Insulators

by a curve similar to the time-lag curve, and it is incorrect to give a single value of the impulse ratio without specifying the particular wave to which it corresponds. Furthermore, one point does not establish a curve under any circumstances.

The impulse-ratio curve for a seven-unit string of $5\frac{3}{4}$-in. spaced suspension insulators is shown in Fig. 3. It is seen that impulse ratios between 1.1 and 1.9 may be obtained by varying the impressed voltage. An impulse ratio value obtained by using any specified wave merely gives one point on the curve and conveys relatively little information concerning the characteristics of the apparatus. The impulse-ratio curves for transmission line equipment approach a fairly constant value of from 1.1 to 1.4 at approximately 15 microseconds.

Hence, any wave which is appreciably above the 60-cycle breakdown value of the insulation after 15 microseconds will flashover the insulation. Impulse ratios of two and three merely indicate that, with a certain type of wave, it is possible to apply such voltages before flashover occurs. Impulse-ratio curves are useful for extrapolating or interpolating data for similar equipment with different 60-cycle breakdown values.

Lightning Wave Records Are Needed to Check Research

Available data on the actual wave form of lightning voltages on transmission lines are very meager. Fig. 4 shows the Trafford wave plotted on the same co-ordinates as a wave[5] recorded on a 154-kv. line of the Aluminum Company of America at Chilhowee, Tenn. The close agreement is particularly noticeable and probably a coincidence. However, it can be confidently stated that to simulate the most severe line conditions a laboratory wave should not attenuate faster than to 75 per cent of maximum in 25 microseconds. But whether such a wave represents mild, medium or severe service conditions cannot be decided from a single record. Laboratory tests with waves which do not approach the above specifications are bound to give optimistic results.

Tests on Apparatus

Time-lag tests[6] have been made on suspension insulators, both plain and with arcing rings of various forms; on pillar insulators, on bushings and on several kinds of gaps. Sufficient data will be included here to illustrate the methods discussed above. In all tests the high-voltage terminal of the surge generator was positive with respect to ground.

Time-lag data have been obtained on suspension insulator strings of from three to sixteen units. Fig. 5

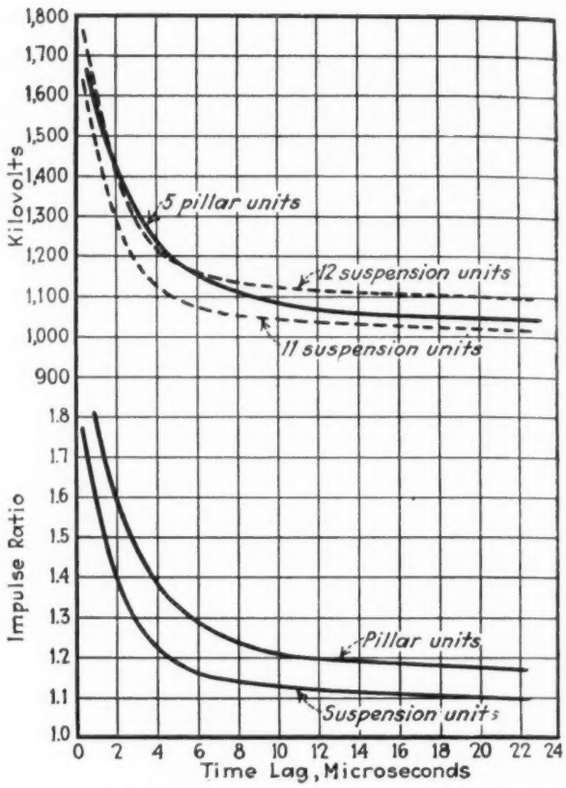
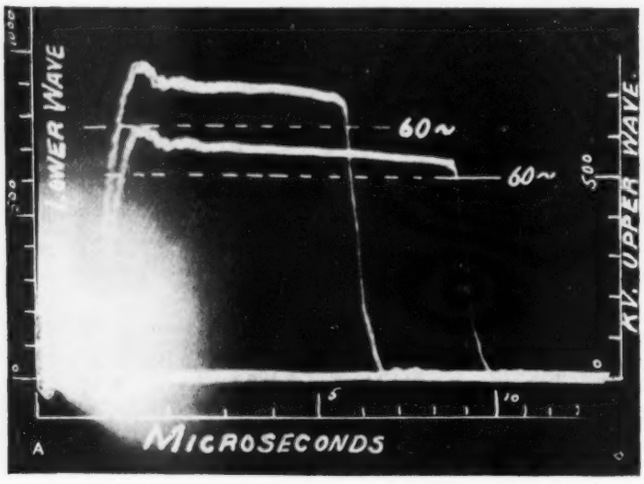


Fig. 10—Time Lag and Impulse Ratio for Pillar and Suspension Units

[5] *Fortescue, Atherton, Cox, "Theoretical and Field Investigation of Lightning, A.I.E.E., Vol. 48, April 1929.*

[6] *Torok and Fielder, "High-Voltage Surge Oscillography," "Electric Journal," July, 1929.*



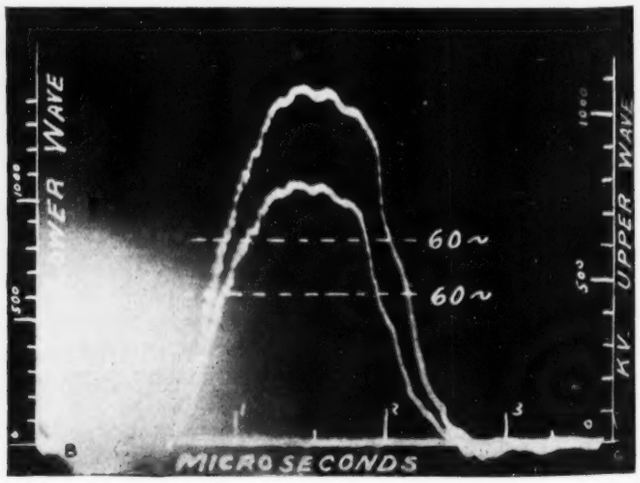


Fig. 11—Typical Oscillograms from Time-Lag Tests on Seven Suspension Units

Two records with different potentiometer ratios are shown on each film. The 60-cycle crest flashover values are indicated by the dotted lines.

(a) Kv.	Time Lag	(b) Kv.	Time Lag
750	4.3	1,080	0.9
720	7.3	1,060	0.9

shows the experimental curves obtained. Individual points vary as much as 10 per cent from the mean curves, although relatively few deviate more than 5 per cent. In drawing curves from limited data on individual strings variations even in the form of the curves are possible. However, it seems reasonable that the surge flashover voltage at a given time-lag value should show an approximately uniform increase with the number of units. On this assumption, and using the data of Fig. 5 as a basis, the time-lag curves of Fig. 6 have been constructed. Actually, the surge data for a given time-lag value indicate the same variation with an increase in string length as obtained in 60-cycle tests. Fig. 7 shows the time-lag curves of strings of two to sixteen units replotted in the more familiar manner from the average curves of Fig. 6.

Although individual experimental points deviate somewhat from these average curves, it has been found in subsequent tests with parallel apparatus that remarkable consistency in flashover performance is obtained even when the respective time-lag curves cross at one or more points. Boundary impulse-ratio curves as calculated from the average curves of Fig. 7 are shown in Fig. 8. Impulse-ratio values for a given time lag has been found to be nearly the same, regardless of the number of insulators in the string.

It is well known that the 60-cycle flashover values of insulator strings are reduced appreciably when the insulators become wet. This reduction is very much less for surge voltages. Impulse tests were made on wet strings of five, eight, eleven and fourteen units. The results show a voltage reduction of the order of 5 per cent at the longer time lags—greater than 5 microseconds. Below 5 microseconds, however, the curves approach the values for the dry condition, until for high overvoltages the voltage for a given time lag is the same whether the insulator string is wet or dry. Fig. 9 shows the results of these tests.

The most striking feature of these results on suspension insulators is the rapidity with which the surge flashover voltage curves approach the 60-cycle breakdown values. The impulse ratio is always below 1.2 at 10 microseconds time lag and, from this point, the slope of the curve as it approaches the 60-cycle breakdown value is very gradual. Torok and Ramberg[1] have attributed this high speed of breakdown on plain insulator strings to a progressive breakdown of individual units in the string.

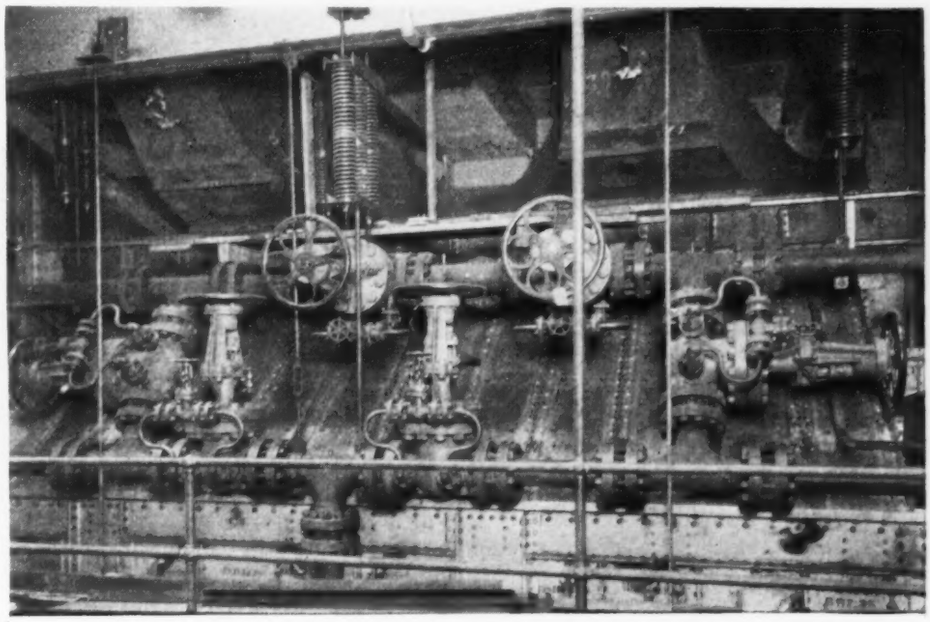
Time-lag curves furnish a ready and useful comparison of the flashover performance of apparatus and insulation. Transmission line and substation apparatus insulation should be graded to assure that flashovers or failures occur at points which will result in the least damage or inconvenience. For example, it is desirable that line insulators flashover rather than pillar units or bushings in a substation. Fig. 10 shows the time-lag curve of a five-unit stack of pillar insulators. It is apparent from the curves that eleven line insulators would always protect the pillar units; twelve suspension units would only offer protection for a small range of voltages. This result can also be obtained by consideration of the impulse-ratio curves. Hence, in applying equipment of a given voltage rating, the 60-cycle flashover voltages of the individual apparatus units should be determined from a comparison of the impulse-ratio curves of the group of apparatus under consideration.

Conclusions

Complete time-lag curves for transmission line apparatus are necessary to predict and control its lightning flashover performance in service. For obtaining this information a surge generator wave which approaches the ideal rectangular form is most satisfactory.

Solving Fittings Problem for 1,600-Lb. Feed Water Lines

DOUBLE nut studs of high-tensile steel threaded full length and unusually heavy fittings are provided for the boiler feed lines in the recent 1,600-lb. additions to the Edgar station of the Boston Edison Company. The feed water temperature entering the economizer is 420 deg. F., which is believed to be the highest thus far used in a generating station, and the water leaves the economizer at something above 500 deg. The bypass piping is of increased flexibility in comparison with older designs in which the bypass valve was bolted direct to the main valve body. Expansion and contraction are effectively cared for in this way. The feed lines shown herewith are sectionalized by valves by which the economizer can easily be bypassed and the symmetrical layout and flexibility of operation provided for are attained in a compact space without confusing purpose of valves.

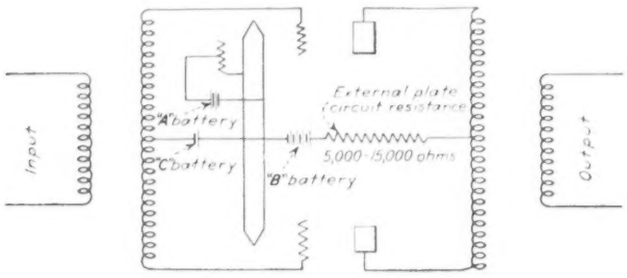


Fittings for 1,600-Lb. Feed Water Service and Economizer Bypass Connection

Acoustic Shock Absorber Protects Telephone Users

By H. N. Kalb
Superintendent of Communication
San Joaquin Light & Power Corporation, Fresno, Calif.

ANY ONE having had experience with power company telephone lines is familiar with the fact that switching and other transient conditions on telephone systems occasionally produce severe acoustic shock to the ears of those using telephone instruments. Pre-



Schematic Diagram for Acoustic Shock Absorber Using Standard Vacuum Tubes in Push-Pull Circuit

cautions have been taken to prevent electric shock by physical contact, but very little has been done to overcome the annoyance and discomfiture of the acoustic shock. Those who use the power company's private phone lines get into the habit of holding the receiver away from the ear for fear of shock. Sometimes acoustic shocks are so severe that a telephone operator is incapacitated for several hours.

Development and research of an acoustic shock absorber have been conducted by a number of people with varying methods and success. An acoustic shock absorber making use of the ordinary type radio tube has been developed by the writer and has been in use on the system of the San Joaquin Light & Power Corporation since July, 1924. Radio tubes are essentially a one-way device and consequently can be used in the receiver circuit only. The characteristics of these tubes are such that with a given plate voltage the current that can be passed may be limited by the insertion of a resistance in the external plate circuit; for a given plate voltage and given external plate resistance there is a certain maximum plate current regardless of the grid voltage; also the plate current varies with the plate voltage. Thus it is possible to use a definite plate voltage, a definite external plate resistance and the proper grid bias and thereby obtain a current-limiting device.

Knowing the amount of current required through the operator's receiver to produce an acoustic shock, all that remained was to limit the plate current to less than that amount. It was found more difficult to get good reproduction from one tube than when two were used in a push-pull amplifier. Therefore, the final set-up was as shown in the accompanying diagram.

In the telephone system of the San Joaquin Light & Power Corporation a 44-volt storage battery is used for the telephone switchboard and accordingly the "B" battery voltage was chosen as 44 volts and the other constants fixed accordingly. The operator's headset is provided with two extra contacts, so that when plugged into the jack the filaments of the tubes are lighted and when the plug is removed the filaments are disconnected from the "A" battery. With this acoustic shock absorber in use the operators wear their headsets all day without fear of acoustic shock, resulting in better and speedier telephone service.

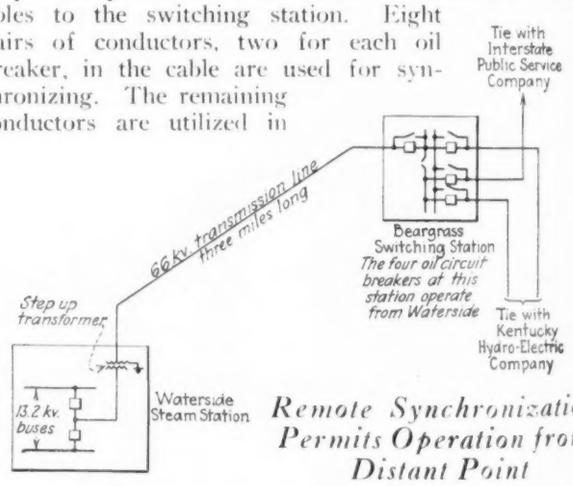
The type of tube to be used depends upon the amount of service that will be required. The constants to be used in the circuit will depend upon the tubes used and the best available supply for the "A" and "B" batteries. Therefore it is not advisable to designate any of the constants except for specific cases where the conditions of operation are known.

Line Switching Controlled by Synchroscope

By Charles Ewing
Operating Department, Louisville Gas & Electric Company, Louisville, Ky.

REMOTE synchronization of generating machinery controlled from a distance is not uncommon, but the paralleling of transmission lines with the synchroscope several miles away is not so often encountered. At the Bear Grass switching station of the Louisville Gas & Electric Company four 66-kv. lines enter. One is from the Waterside steam station of the Louisville company, two are from the Dix Dam hydro station of the Kentucky Hydro-Electric Company and the fourth ties into the system of the Interstate Public Service Company.

The four oil breakers are controlled and their operations supervised from Waterside, 3 miles distant, over a 50-pair telephone cable carried on the transmission line poles to the switching station. Eight pairs of conductors, two for each oil breaker, in the cable are used for synchronizing. The remaining conductors are utilized in


Tie with Interstate Public Service Company
66 kv transmission line three miles long
Beargrass Switching Station
The four oil circuit breakers at this station operate from Waterside
Tie with Kentucky Hydro-Electric Company
Step up transformer
13.2 kv. buses
Waterside Steam Station

Remote Synchronization Permits Operation from Distant Point

the control and supervisory circuits and for telephone connections to the carrier-current transmitter and receiver, which are installed in the switching station. The potential transformers for synchronizing have 110-volt secondaries and on account of the length and small size of the conductors it was necessary to use a synchroscope of very low operating energy requirement to minimize the voltage drop in the circuit. There are no selective devices in the synchronizing layout. A pair of conductors is carried straight through to the operating board at Waterside from each side of each breaker in the switching station and the operator simply plugs in the synchroscope for the particular switch to be closed.

Remote Metering

Over Telephone Lines

By L. A. TERVEN
Technical Engineer West Penn Power Company

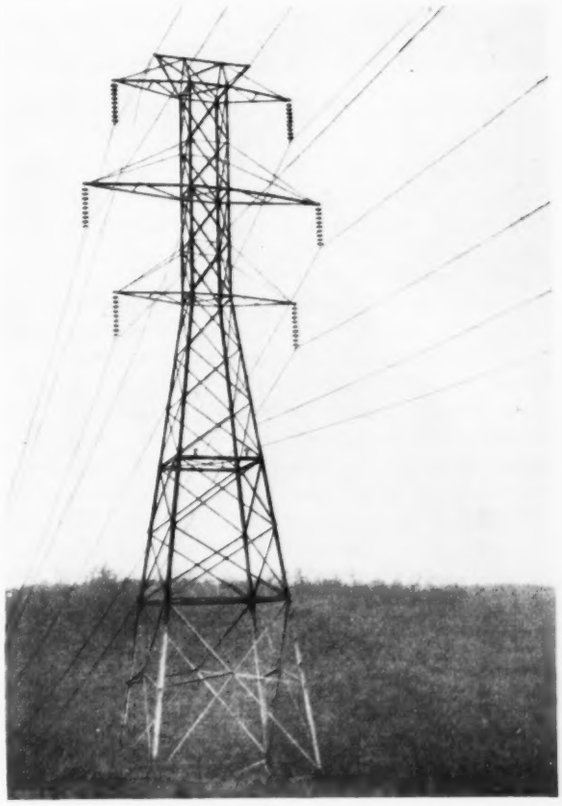
How generated power is totalized and readings transmitted to load dispatcher. Features of equipment. Method of functioning. Precautions taken to assure reliability

USUALLY it is desirable to have an indication of the power generated in each plant and total output of all directly in view of the system operator. It is also a great advantage to have central indication of loads at interconnection points. Possibly engineers who are seeking to provide these aids to load dispatching may find something of value in the method of totalizing the load of the Windsor station, transmitting it to Charleroi, 46 miles distant and guarding against false or interrupted indications.

An accompanying diagram shows how a totalizing wattmeter circuit was obtained by inserting proper ratio current transformers in the secondaries of the current transformers which are installed on the 11-kv. main power transformer leads. Ratios are chosen to give full-scale reading at 160,000 kw. The current of the totalizing wattmeter circuit passes through the demand meter, which closes forward or retrieve contacts for every 200 kw.-hr. passed through the watt-hour demand meter. The meter contacts are designed for 60-cycle, 110-volt alternating current, which is supplied from a 1/1 insulating transformer to avoid having ground potential on the wiring, since the local lighting service is 220-110 volts with grounded neutral. Precautions were taken to avoid any grounds near operating lines, as otherwise surges induced by the high-tension transmission lines would jump through to such points instead of discharging at the arresters supplied for the purpose.

The meter contacts control the coils of four small relays (type "F.R." Roller Smith) which act as a two-pole, double-throw switch. The relay coils, which operate on 110-volt alternating current, can take only a very small current, otherwise the demand meter contacts will be injured. It was difficult to procure suitable relays and the ones now in service require careful maintenance, probably due to the effects of surge currents upon the flexible leads to the contacts.

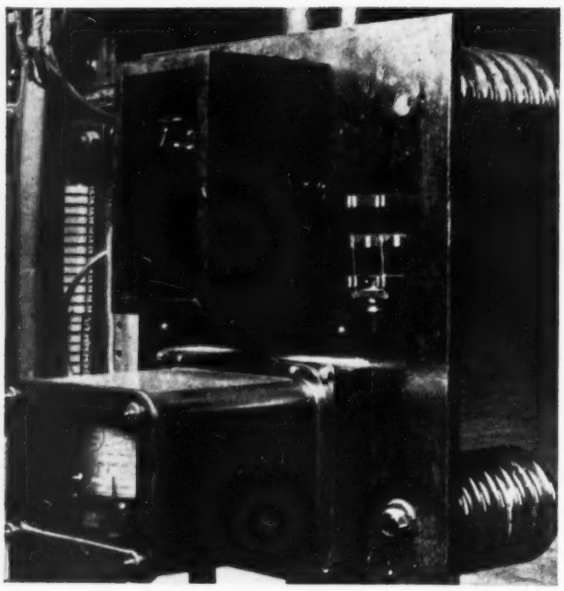
Direct current passes through the contacts of the F.R. relays at about 10 volts potential, the object being to transmit a direct-current impulse of one polarity for a "notch up" and an impulse of the opposite polarity for "retrieve." Pulses in one direction could have been used, using gravity or spring action for a retrieve. But under such conditions a surge upon the line would give a wrong indication, and chattering of meter contacts, due to mechanical vibration, would cause a rapid and incorrect notching up of the demand meter at the load-dispatching terminal. Duplicate 10-volt batteries are used so that one battery can be on charge while the other one is being used. Use of one battery continually floating on charge was objectionable because of the ground connection of the neutral of the 60-cycle lighting system used for charging.



Metering Impulses Transmitted Over Telephone Wires on This 132-Kv. Line

Two ground wires at top. For part of route a 25-kv. line is interposed between 132-kv. line and telephone wires.

From the contacts of the F.R. relays the direct-current pulses pass through a resistance and reactance network. The resistance prevents excessive currents from flowing in case of local short circuits on the telephone lines, while the reactance provides a protective filter against incoming surges from the high-tension lines. The reactance also smoothes the pulses of direct current so that the rate of rise of current will not be great enough to click the telephone ringer of the Windsor tele-



Polarized Relays at Receiving End

phones nor permit the drops to fall on the telephone switchboard. The direct-current pulses in the telephone line are of the order of only 5 milliamperes because incorrect telephone ringing would occur with higher currents.

The direct-current pulses reach the high-tension telephone line through the split primary of the telephone insulating transformers. These transformers are of 1/1 ratio, the primary being insulated for 25,000 volts. Both primary and secondary are wound in two parts, and in this case the primaries were connected in series while the secondaries were placed in parallel, as it was found by trial that this method gave the best telephone transmission. It is customary in construction of such transformers to place a grounded metal-foil shield between the primary and secondary in order to prevent surges from the line side being transmitted by capacity coupling into the secondary.

The primary of the telephone insulating transformer is closed for telephone purposes through a 4-mfd. condenser. High surge potentials frequently exist across this condenser so it is shunted by a resistance, spark gaps and a gas-tube telephone line protector which discharges either or both lines to ground, or line to line, as all three electrodes are adjacent inside the tube. The shunt resistance imposes a heavier duty on the F.R. reversing relays, but there are less induced currents of a high order than was the case before its use. A small double-scale milliammeter monitor is provided so that the operation of the circuit can be checked.

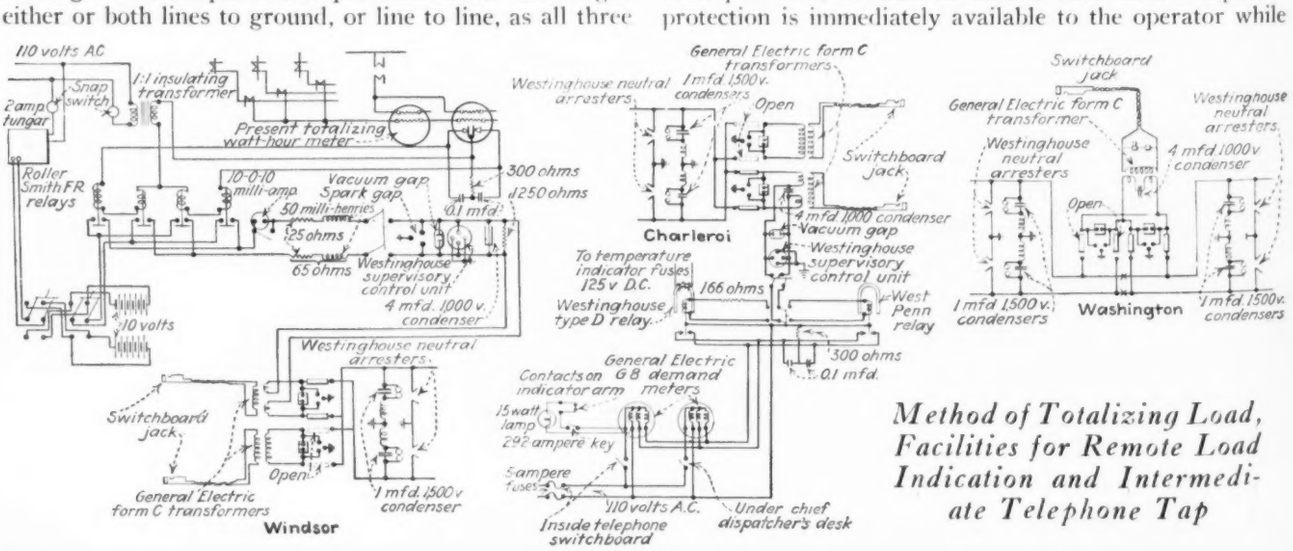
The high-tension side of the insulating transformer is protected by a line-to-line vacuum discharge device, spark gaps connected line to line and line to ground, and 5-amp. fuses. The incoming line is protected by 6,600-volt horn gaps, which are supposed to hold the line potential down after the 5-amp. fuses have blown. A drainage coil consisting of a 10-kva., 2,300-1,150-volt transformer is inserted at the horn gaps. Ordinarily such a transformer would have the 220-110-volt side open circuited, and the telephone lines would be connected to the outer ends with the center tap grounded. In this case it was necessary to prevent direct current from flowing in the coils, so condensers were placed between the lines and the coils. Protective gaps around the condensers consist of "neutral" lightning arresters, usually rated at 300 volts discharge. The condensers are tested for 1,500 volts and have 1 mfd. capacity.

How Telephone Line Was Adapted

The metering impulses are transmitted over a privately owned telephone line supported upon the same structures as the high-tension power lines between Windsor and Charleroi. High voltage is induced upon the telephone line so transpositions are placed in the telephone line at each tower and two complete transposition barrels in the power line between Windsor and Charleroi. Even with these transpositions, however, the unbalance to ground is high, and currents in excess of 1 amp. are common in the neutral of the drainage coil when the isolating condensers are not in service.

At Washington, an intermediary point in the Windsor-Charleroi line, a tap is in the telephone line. Protection is provided on the incoming and outgoing circuit, the drainage coils being isolated by condensers to avoid short circuiting the direct-current impulses for metering. So the insulating transformer will not obstruct the direct-current impulses a 4-mfd. condenser is placed in its center.

At Charleroi the high-tension telephone line is protected the same as at Windsor sending end. At both places duplicate insulating transformer, fuses, etc., have been provided, so that in case a fuse blows duplicate protection is immediately available to the operator while



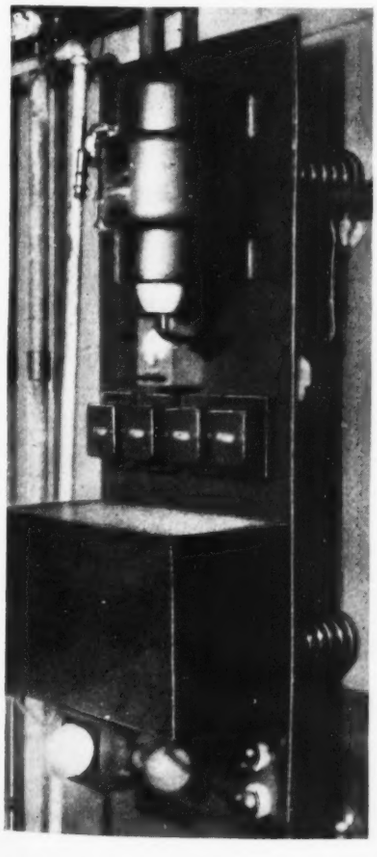
Method of Totalizing Load, Facilities for Remote Load Indication and Intermediate Telephone Tap

the fuse in the faulty section is being replaced. As before, the primary of the insulating transformer is split, so that a direct-current circuit may be inserted around the condenser, the latter serving to pass the voice-frequency currents of telephone communication as well as the 19-cycle magneto ringing current.

The direct-current extension circuit is protected with a gas-tube protector and spark gaps, as at Windsor. The circuit goes into the middle terminals of a double-pole, double-throw switch, so arranged that either of two relays may be used for receiving the direct-current pulses.

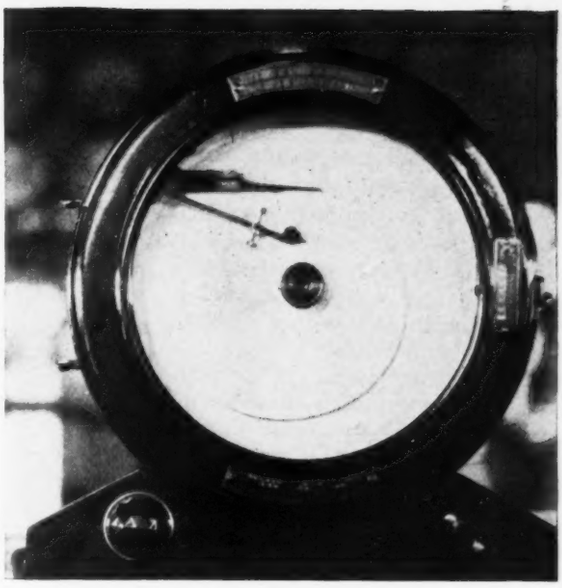
The contacts of the double-throw, single-pole relays make and break a 110-volt, 60-cycle alternating-current circuit, which operates two demand meters in parallel. The meter pointer notches up at the rate of 200 kw.-hr. per notch, returning to zero at the end of every fifteen minutes. The dial of the meter is actuated by a synchronous motor which makes one complete revolution of the dial every fifteen minutes. A curve has been placed upon the dial showing the load which the dispatcher is not to exceed. If the load is exceeded during a part of the fifteen-minute period, the load dispatcher takes up load at other generating stations than Windsor in order to cut back on the demand. The demand meter does not record, but the pointer simply follows the chart. Different charts are provided for different maximum loads which may be carried.

An additional refinement has been added to the chart of the second meter. An insulated pair of contacts has been arranged upon an arm which rides upon a micarta spiral above the arm of the demand meter. In case the demand is exceeded and the demand meter arm rises above the fixed curve the floating arm will be raised by the pointer from its position of normal contact with the micarta spiral. When this takes place the contacts on the floating arm close and a signal lamp lights and remains so until the demand is cut back under the load curve corresponding to that particular time.



Insulating Transformer, Monitoring Ammeter, F. R. Reversing Relays and Charging Compartment at Windsor

From the time that the equipment was placed in service a great deal of difficulty was encountered in the proper protection of the devices. Charging of the 132-kv. electrolytic lightning arresters at Windsor and Washington induced heavy surges upon the telephone line. Numerous surges also occurred on the telephone lines due to switching changes and in two or more cases we had actual physical contact between the 132-kv. lines and the telephone lines. Of course numerous high-voltage effects were experienced due to customary lightning disturbances during the summer months. Induced surges would break to ground through the battery charger before an insulating transformer was installed. High-current surges would melt the flexible leads of the four small relays at Windsor. It is believed that this trouble was due to the protectors on one side of the line failing an appreciable time before those on the other side. Such action would permit a heavy current to flow through the side which had not failed and hence through the transformer winding to ground. A gas-filled tube (Westinghouse manufacture) containing four electrodes is used for protection at present and is giving excellent results. This tube is connected so that two of the electrodes are at ground potential. The other two electrodes are connected to the telephone lines.



Curve on Demand Dial Helps Dispatcher Avoid Exceeding Load Limit

Signal lamp lights when load limit is exceeded.

Klydonograph records on the telephone line indicated that when the 132-kv. lightning arresters were being charged at either Windsor or Washington the induced voltage from either telephone wire to ground was of the order of 4,000 volts. About 3,000 volts appeared across each of the split primary windings of the telephone insulating transformers at such time, but no voltage was recorded across the condenser, which is in series with the two primary windings. However, the klydonograph is not capable of registering smaller voltages than about 2,000 volts. As practically all of the voltage present is from line to ground the protectors will effectually protect the apparatus provided everything is well insulated from ground. The panels and equipment are so arranged that a high value of insulation is maintained against ground and every precaution is made to prevent weak spots from developing between wiring of the equipment and points at ground potential.

The equipment has now been in service for more than a year and has given excellent results. The cost of maintenance is rather high due to the distance between stations, but it is felt that the expense is justified.

Illumination or Wiring Standard—*Which?*

Franklin specification proposes a standard of illumination, whereas California commercial "red seal" plan would make adequate wiring basis of approach to problem

By J. R. Cravath
Consulting Illuminating Engineer, San Francisco, Calif.

RECENT discussions in the Electrical World regarding the Franklin specification suggest some other points in connection with these specifications for commercial and industrial lighting that have had considerable discussion outside the columns of the technical press. The Franklin specification for commercial and industrial lighting represents an effort on the part of the electrical industry to outline approximate methods of designing the illimination for the ordinary types of commercial and industrial interiors. They are drawn up with the idea that a definite illumination plan is first to be worked out from certain approximate tables and the outlets and wiring laid out to fit. The plan was first adopted by the Electrical Association of Chicago as a part of a general electrical industry movement to promote better lighting conditions. It has since been adopted by the Society for Electrical Development as a national standard for the same purpose.

Inasmuch as certain objections to the Franklin specification have been made at various times and have had considerable discussion which has not appeared in print, it may be well at this time to review some of these arguments in order that a clear view may be obtained of the situation now existing.

Objections to Franklin Plan

When the Franklin plan was first proposed it met with some objections from certain engineers who felt that it was an attempt to settle by approximate rules certain matters of design which should be given more careful attention than the application of the Franklin plan would involve. It was argued that illuminating engineering was not by any means as simple as the Franklin specification would imply, and that there was little incentive to men of ability to give their lives to the study of illuminating engineering if the whole thing simmered down to a few "rules of thumb."

The answer to the foregoing arguments which seems to have found general acceptance, as evidenced by the adoption of the Franklin plan by the Society for Electrical Development, was somewhat as follows:

The Franklin specification is intended to cover a large number of the common every-day cases. Such cases would be handled even by the skilled engineer, by the use of a few simplified methods, similar to those laid down in the Franklin specification. It was also argued that if the use of the Franklin specification could be made general, it would help conditions in a hundred cases, to one where it would interfere with an intensive study being made by a skilled engineer, for, after all, it seems inevitable that under present building customs no very large percentage of the total number of commercial and industrial buildings will receive intensive illuminating engineering study. Advance in engineering and scientific matters is always accompanied by simplification and popularizing of the results first worked out with difficulty by scientists and engineers, and it is only by such a process that the work of scientists and engineers becomes available for the greatest number.

The objections to the Franklin plan discussed in the previous paragraphs were based upon the feeling that the specifications were not complete nor sufficiently elaborate. It is interesting to note that another class of objections to the plan is based on the feeling that it is too elaborate to be applied at the time that the building plans are being completed, in a large number of cases.

It is admitted by the objectors of this last class that the idea of planning the lighting first before any wiring plans are drawn up is entirely logical and ideal, and in the case of large and important buildings, where the occupancy is definitely known in advance, there is no good reason why this cannot be done. However, the fact remains that a very large percentage of the total amount of commercial and industrial building is not of that class and is along well-established lines to which certain general rules can be applied. Architects and builders have been in the habit of laying out the outlets and drawing wiring specifications for bids at the time the general building contract is let. The completion of plans is at a time of high pressure in the office of the architect who handles this class of work, and to get him to change his habits enough to make complete lighting plans in advance of the wiring specifications is revolutionary as far as he is concerned. In this class of work it simply "isn't done," nor is it likely to be done in the immediate future. The architect and builder on this class of building have for many years figured in watts per square foot. In view of the fact that the occupancy or class of tenants is frequently uncertain at the time the wiring contract is let, it is difficult to persuade the architect or builder that he should spend time in making, or having made, complete lighting plans for some hypothetical tenant who may be changed before the building is completed. He figures that the best he can do is to provide a proper number of watts per square foot for lighting with a distribution of outlets which will distribute these watts with fair uniformity over the area to be lighted and let it go at that. He will also probably produce figures to show that 90 per cent of the commercial and industrial buildings can be handled by properly drawn up general rules based on a minimum number of watts per square foot and proper distribution of outlets.

It must be admitted that whether those interested in illuminating engineering like this way of doing business or not, this is the way that the building business *is* done, and some degree of conformity to the conditions to be met is necessary if any progress is to be made in the introduction of adequate wiring to permit better standards of illumination.

California "Red Seal" Plan

With the feeling that expedient rather than idealistic methods should be used, there has been set up in California a "red seal" plan for wiring of commercial and industrial buildings. This plan is sponsored by the California Electrical Bureau, a co-operative organization of the electrical industry in the state. The idea underlying this specification is that if the habit of adequate wiring can be established in the architectural and building world adequate lighting will be made possible in the future. With inadequate wiring installed in commercial buildings which are going up, a difficult

barrier is set up against lighting progress. Better wiring of commercial and industrial structures is fundamental.

The California "red seal" wiring specification for commercial buildings is based on 3 watts per square foot, with modifications up or down for certain classes of interiors and provisions for special cases, such as show windows, etc. It has been indorsed by a sufficient number of organizations to carry weight with architects and engineers and gives the architect something authoritative and definite to justify an adequate wiring layout instead of the very indefinite data he has had heretofore for handling the ordinary run of jobs.

While some may think it unfortunate that the electrical industry in California has seen fit to adopt a different plan from that sponsored by the Society of Electrical Development nationally, it must be remembered that advance can come only through experiments of this sort, and in the long run whichever plan works the best in practice will be the one generally adopted. The electrical industry in California is better organized to conduct an experiment of this kind than in some other localities on account of its isolation from the rest of the country, and the results will be easier to measure.

Open-Door Losses Determined for Electric Furnaces

THE open-door losses for a given furnace temperature will depend upon the area of door opening, time door remains open, the number of openings per hour and design of furnace front and door. There are so many variables that it is not practical to give an average figure for this loss. If a door is opened once or twice an hour for very short periods this loss can be neglected, but in the case of a box type vitreous enameling furnace, where the door is opened 30 to 40 times an hour, this loss may exceed the stand-by loss. Test observations of open-door losses may be made.

An actual test of a box type furnace operating at 1,600 deg. F. having a door 4 ft. wide, opened a distance of 18 in. high, for a period of ten seconds plus additional eight seconds for opening and closing, gave a loss of 1 kw.-hr. for each time door was opened.

**As indicated in a paper, "Calculation and Operating Costs of Electric Furnaces," presented by R. M. Cherry of the General Electric Company at the Industrial Electric Heating School, Case School of Applied Science, Cleveland, Ohio.*

Federal Regulation Unnecessary

Says Oregon Governor

I. L. Patterson

EXPRESSING his views on the Couzens bill to a representative of ELECTRICAL WORLD, Gov. I. L. Patterson of Oregon stated that in his opinion federal regulation of electric utilities should be left to existing boards and commissions. Asked how state regulation had worked out in Oregon he said:

"State regulation of public utilities has accomplished much for the state of Oregon. Subject to the limitations which are imposed on all state regulatory bodies, I believe state regulation has, in general, been reasonably effective in securing satisfactory service for the people of this state. If properly administered, it should care for future needs."

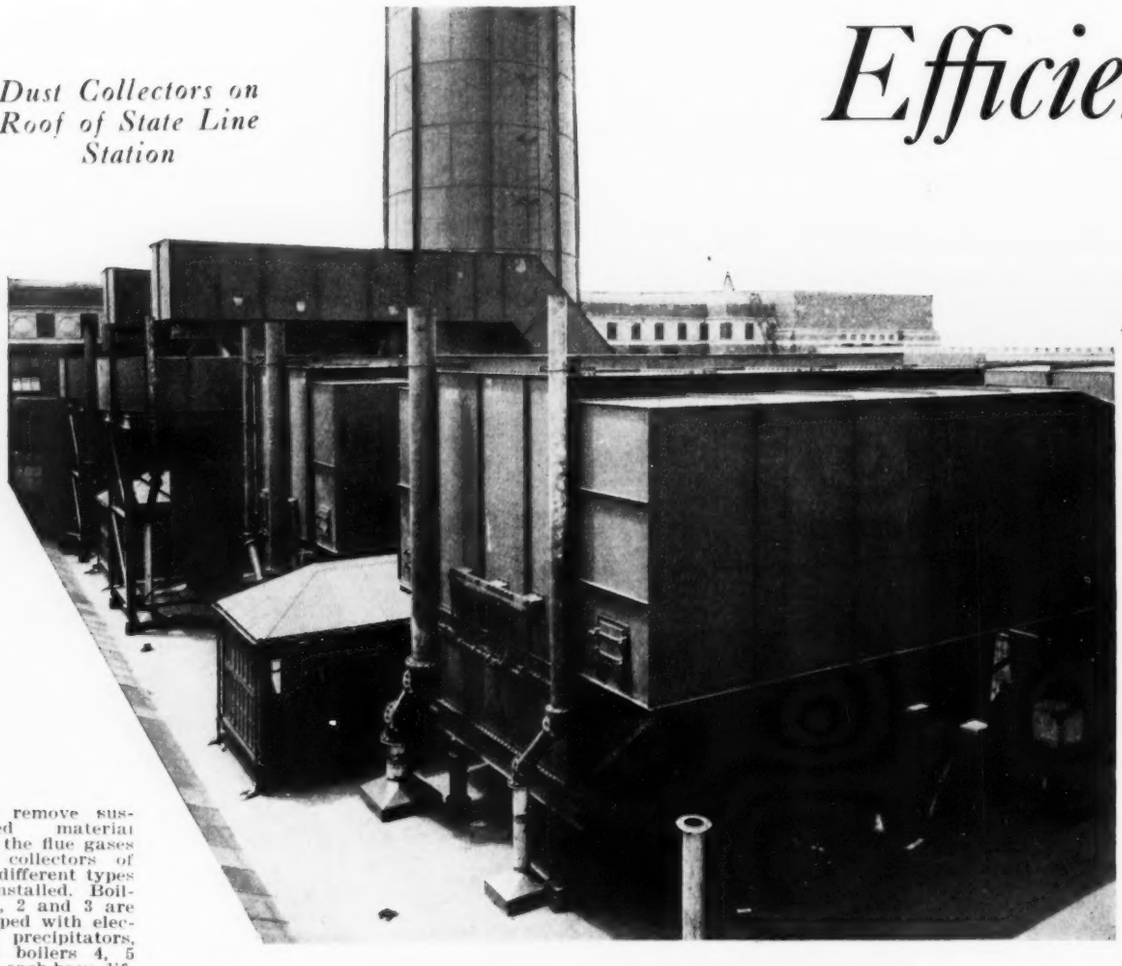
What do you think about federal regulation of utilities; is it needed? the Governor was asked.

"I do not believe that present conditions warrant further federal regulation of utilities at this time. With possible minor exceptions, all problems affecting public utility companies may be handled by existing boards and commissions, such as the Interstate Commerce Commission, Federal Power Commission, Federal Trade Commission and Board of Radio Commissioners. Most of the problems affecting public utilities are of a local nature and should be left to state authorities. Where two or more states are concerned, no difficulty has heretofore been experienced in the Pacific Northwest in handling matters of common interest through cooperation of the respective commissions of the states involved."

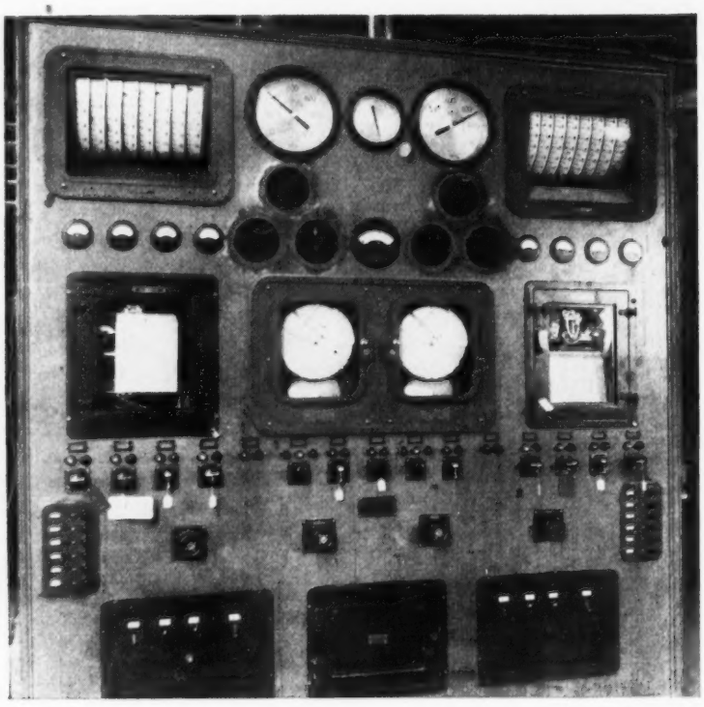
As a method to institute federal regulation Governor Patterson does not consider the Couzens bill meritorious in that it tends to encroach upon state rights and would increase federal regulation to an extent which present conditions do not seem to warrant. "There would appear to be danger under such a bill of federal interference with intrastate regulation of public utility companies," he said. "The provision of this bill authorizing the proposed federal commission to over-ride the laws of the respective states and the decisions and orders of state commissions would seem to be undesirable."

State Line Features *Efficiency*

Dust Collectors on Roof of State Line Station



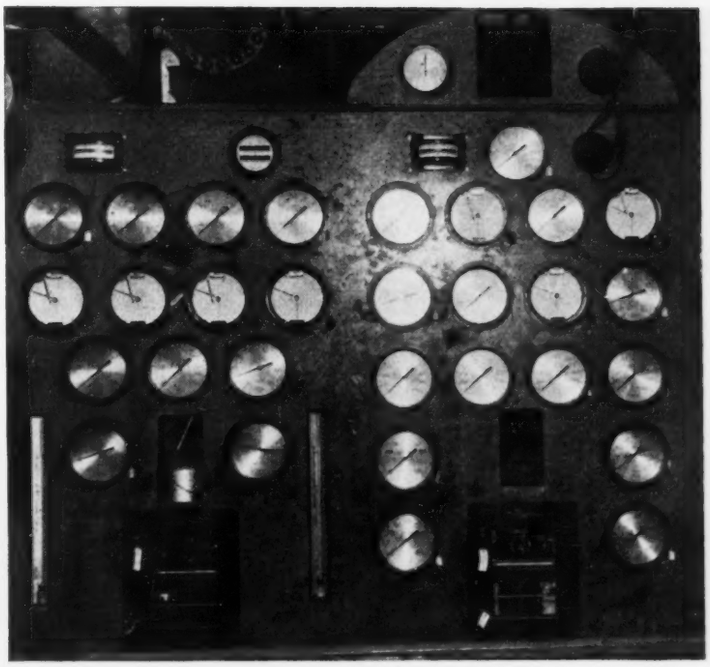
To remove suspended material from the flue gases dust collectors of four different types are installed. Boilers 1, 2 and 3 are equipped with electric precipitators, while boilers 4, 5 and 6 each have different types. They are capable of handling 170,000 cu.ft. of gas per minute at 335 deg. F.



Control of Each Boiler Centralized in Such Panels

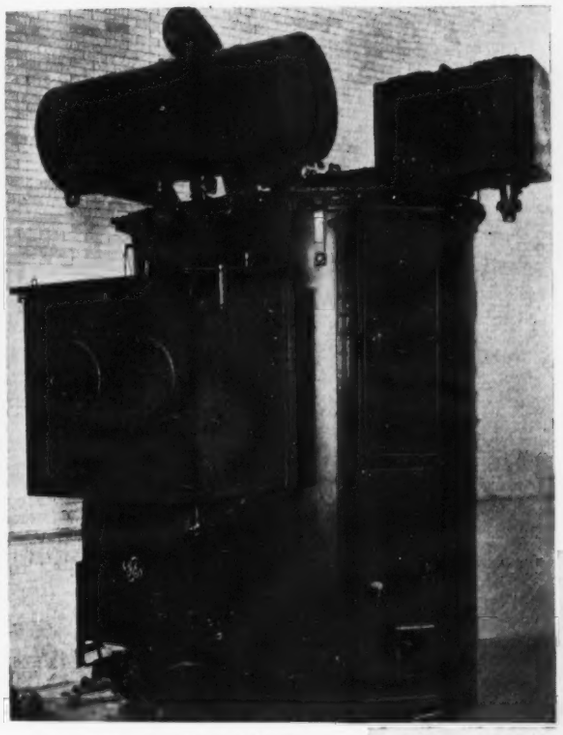
Among the instruments on this board are: Steam-pressure, boiler feed, air pressure, steam-flow, mill-feed tachometers, and boiler-flow venturimeters.

Cleanliness and Safety



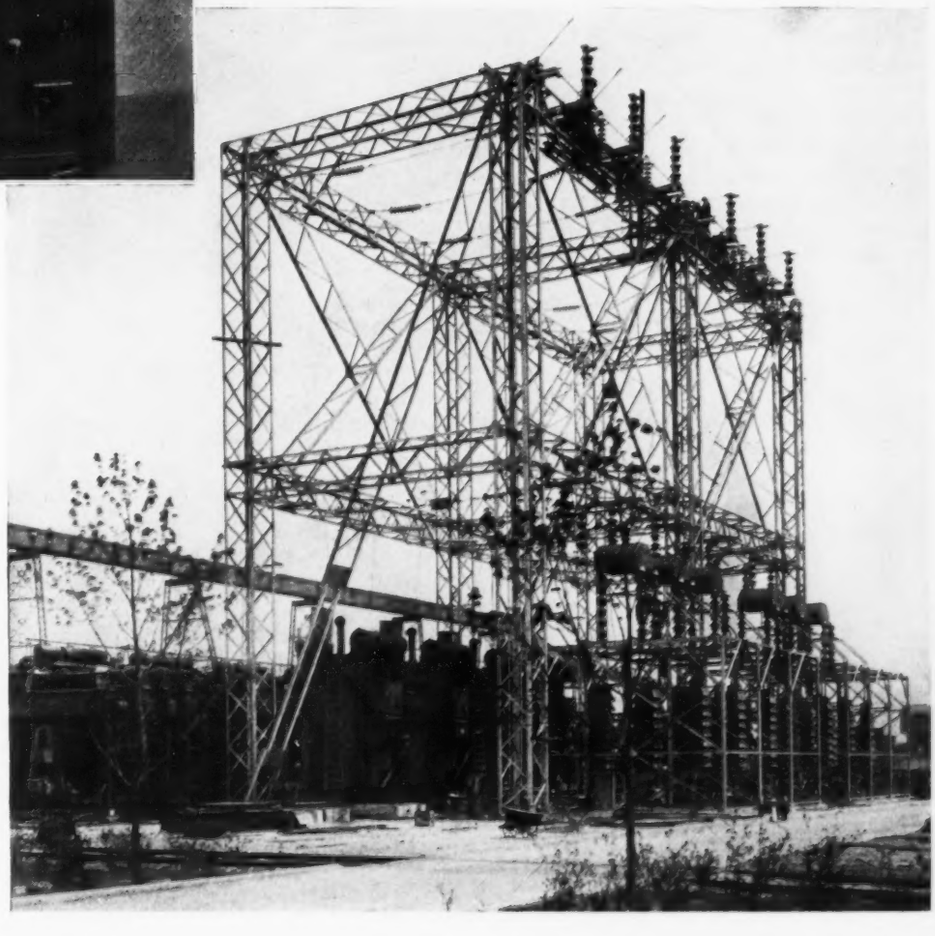
Portion of Turbine Room Operating Board

On this portion are such instruments as indicating and recording pressure gages, indicating and recording thermometers on turbine inlets and exhausts, turbine speed tachometers, lubricating oil thermometers, oil pressure gages and vacuum gages.



One of the 20,000-Kw. 66-Kv. Transformers

The elimination of overhead open wiring by covering all electrical connections is a feature of the outdoor equipment, the metal-clad switchgear and buses being illustrated in the November 2 issue of the ELECTRICAL WORLD. These transformers are equipped with bushing type current transformers, oil-immersed high-tension disconnects and load-ratio control.



Dead-End Structure for 132-Kv. Lines

Energy from State Line is transmitted at 33, 66 and 132-kv., depending on the distance, to the Commonwealth Edison Company, Public Service Company of Northern Illinois, Northern Indiana Public Service Company and Interstate Public Service Company.

Engineering Impetus Needed for Appliance Sales

Better utilization of plant investment on distribution systems rests on intensive sales development

By Walter Stuart Kelley
Brookline, Mass.

INCREASED net earnings in a given utility territory must come from (1) reduction in operating costs or (2) greater use of electricity by existing customers. Better engineering reduces costs, better salesmanship diversifies demand and puts more load on existing equipment.

The past ten years has been marked by notable engineering achievement; during this period the engineer has had his innings and base hits have come thick and fast. In the face of rising costs of labor and material, there has been a really marvelous reduction in the cost of producing electricity. But what of the future? One thing is certain, there will not be anything like such a reduction in production costs in the next ten years, based on turbine operation, steam or water. The margin left for improvement is too small.

Challenge of the Future

In the use of electricity is a wide margin for increased net income. Sales methods are still in the primitive stage. Basically storekeeper methods of selling still prevail. It is hard to break with custom, long-established methods, with tradition; a washer is sold to one, a sweeper to another, a refrigerator to a third, and salesmanship is exhausted after each sale. The actual gain in loading of lines is distressingly small.

For five years the automobile industry has been discussing the saturation point, but apparently it is still far in the future. Has the electrical supply industry even dreamed of a saturation point? Central stations are not within hailing distance of the idea, let alone the condition itself.

If the output of a textile plant is but 70 per cent of capacity the profit and loss balance is apt to be in red. If the steel industry drops to 80 per cent capacity factor in "unfilled orders" the world takes notice, if it drops to 70 per cent the "Lords of Finance" put their heads together to avert a panic. No other leading industry in the world could survive with a capacity factor of 15 to 20 per cent, as prevails among individual central stations. Interconnection is helping somewhat to lift the central station average, and the base-load plant of large systems reaches 60 to 80 per cent. But with the best present interconnected systems showing a 24-hour capacity factor of 80 per cent for base-load plant, with the individual stations showing 40 per cent on a twelve-hour basis—all of it engineering achievement—the merchandising situation still reflects nineteenth century habits and traditions. As a result the domestic load curve has but slightly improved.

Central-station executives are beginning to appreciate the advantage as well as the possibility of achieving two fundamentally important objectives in the domestic field —diversity and better loading. Achievement of these objectives, however, is conditioned on establishing rates very much lower than the ordinary lighting schedule.

In a paper entitled "Motor Load of Massachusetts Central Stations," published in the Electrical World, October 6, 1910, the writer showed by tables and curves the ratio of price per kilowatt-hour to population and to volume of sales. The worst population ratio, 114 per horsepower of motors connected, was for a city that had the highest kilowatt-hour price, 5.14 cents. The five stations with the highest (worst) population ratio, 40 to 114 per horsepower, had power rates from 4 cents to 5.14 cents. The five stations with the best population ratios, 7 to 17 per horsepower, had power rates from 2.49 cents to 3.3 cents per kilowatt-hour; one of these latter had the highest ratio of power load to total station load.

For a manufacturer, a low power rate tells but half the story; a properly engineered motor distribution is equally important in securing low cost of power. In the domestic field, however, the price per kilowatt-hour tells the whole story; it is the one fundamentally important factor.

Full Use of Service the Objective

Average sales to domestic customers now fall largely between 30 and 40 kw.-hr. per month, say 450 annually, whereas it should be, can be and will be in most communities that much per month for one-half of domestic consumers. How soon that will come about in any community depends more on the central management than on all else.

Such a density of distribution in a reasonably concentrated residence area would be profitable at a figure approximating the power rate. A difficult hurdle must be surmounted; it is, to effect such a radical reorganization of appliance merchandising as will place $1,000 worth of appliances where $100 worth is placed today, and that value or more in each household, of a selected list.

In any reasonably prosperous community of 50,000 population right methods of merchandising should place $100,000 worth of household appliances in a 30-day selling campaign; this to be repeated at intervals till one out of three of the households connected is using a full domestic equipment. To organize such a campaign is an engineer's job, not that of a salesman.

As soon as some executive comes to realize fully the extent of the relatively untouched domestic field and has the courage to break away from age-old methods he will stage a campaign of merchandising designed to accomplish what has been set forth. To market $1,000 worth of appliances at a profit in less time than it takes now to sell $100 worth is well within the limits of accomplishment. When one station has done this the wonder will be that it was not done before. The news will travel fast, others will quickly follow suit, and electrical service will break into a new era of usefulness and profit.

Voltage Complaints on Radio Sets

By J. E. Deines
Kansas Power & Light Company, Topeka, Kan.

AS THE number of all-electric radio sets added to the alternating-current lines of power companies increases they receive more and more complaints of poor voltage, although the more modern sets are equipped with voltage regulators and voltage taps that should care for such troubles. No doubt some complaints are justified, but in many cases they are not.

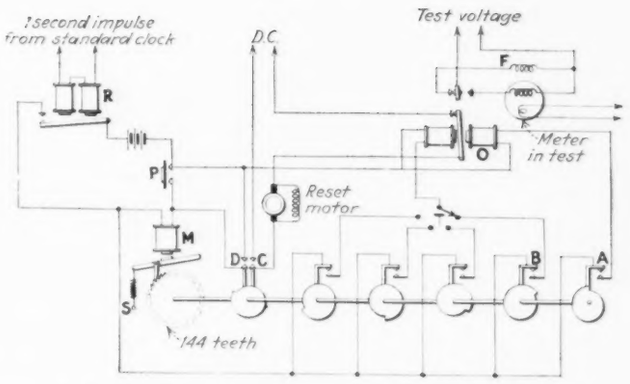
Any number of set owners say that when they turn on their electric iron or similar heavy-duty apparatus the volume of their program falls off appreciably or entirely. Investigation of these cases shows that the voltage drop at the set is only two to four volts. This might cause a slight loss of volume, but should not cause a set to "go dead" if the tubes are in good condition and operate at the correct voltage normally. Checking the tubes in such sets showed that one or more of them were on the border of usefulness; either the filaments had deteriorated or the electron emission had been greatly reduced. The tubes which cause the trouble are usually found in the radio-frequency stages. In every case of this kind new tubes cured the trouble.

Automatic Timing for Rotating Standards

By H. R. Richardson
Laboratory Engineer Brooklyn Edison Company, Inc.

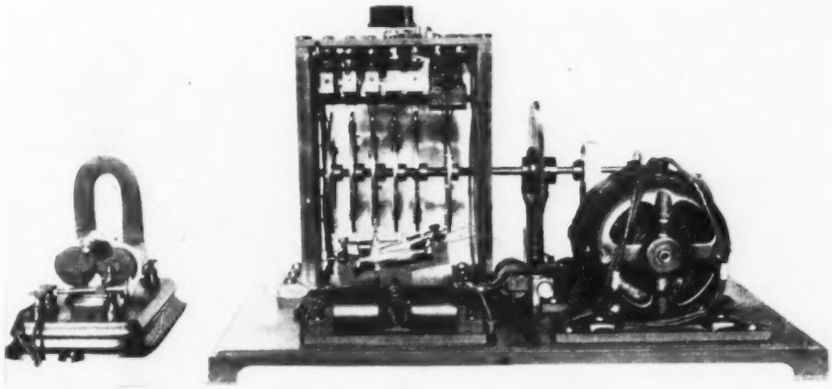
DIFFICULTIES encountered in testing rotating standards for checking customers' watt-hour meters have been greatly simplified by the adoption of an automatic test bench by the standards laboratory of the Brooklyn Edison Company, Inc.

The automatic timing device is controlled directly by the standard pendulum clock in the laboratory and is designed to close the circuit at any desired time after adjusting the load rather than to wait for the next one-minute impulse, as is necessary with some timers. Oscillograph tests show the error in any single determination of time to be less than 0.02 second, so that the error in closing a 60-cycle circuit for a stated length of time is less than one cycle. With steady power supply and accurate electrical standards but one reading is necessary at a given load, and there is the added advantage that only one operator is needed. This apparatus takes advantage of the fact that rotating standard watt-hour meters are equipped with pointers so that



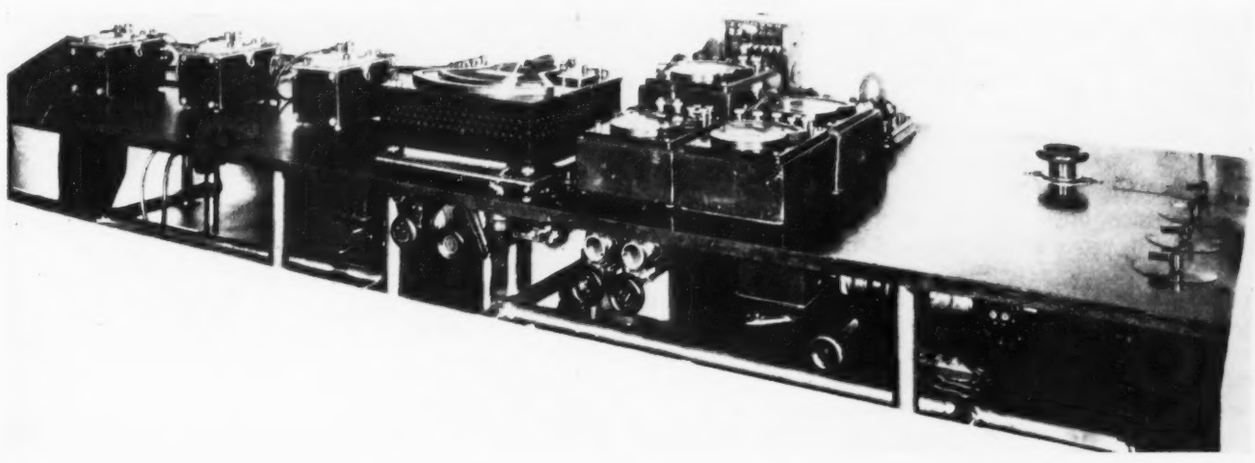
Schematic Arrangement for Automatic Test of Rotary Standards

The operation of the timer is as follows: The relay *R* receives an impulse from the clock once a second. When the push button *P* is closed manually to complete the circuit the relay causes the magnet *M* to put the spring *S* in tension. When the relay opens, the spring returns the pawl to its original position and thus moves the toothed wheel forward at the rate of one notch per second. The contact *A* closes on the back stroke of the pawl or while the relay contacts are open. The next clock impulse throws the potential relay *O* to the right, throwing potential on the meter in test. The cam shaft advances for a time determined by the setting of the cam being used and finally closes contact *B* on the back stroke of the pawl. The next clock impulse throws the relay *O* to the left, taking the potential off the meter and starting the reset motor. At the same time a magnet not shown in the illustration engages the motor gears with the cam shaft. Contact *C* stops the motor and disengages the gears when the timer has returned to the starting position. Contact *D* shorts the manual button *P* after potential has been put on the meter in test by the relay *O*.



Devices Used in Automatic Check of Standards

Automatic timing device is essential element of d.c.-a.c. test bench.



fractions of a revolution may be read on the scale. Also, standard practice in testing house type meters calls for starting and stopping the rotating standard by closing and opening the potential circuit, thus comparing the number of revolutions made by the standard with that of the meter in test. The timer, consequently, was designed to close the potential circuit of the rotating standards in test for any desired time interval from ten to 120 seconds. It consists of a notching relay actuated by impulses from the standard clock and driving a shaft on which are mounted six cams which control the opening and closing of the meter potential circuit. Mercury switches pivoted above the cams are used to control the various circuits and the dial switch mounted on the top selects the timing cam to be used. A motor, at the right in an accompanying figure, automatically resets the mechanism to the starting position after each run. The main potential relay shown in the foreground of one illustration and in detail in another throws the potential from a set of dummy meter coils to the coils of the meters in test, thus making the change with a minimum disturbance of the load.

The relay *O* is symmetrical in design so that the mercury switches will swing to either position with minimum effort on the part of the magnets and also, which is more important, that the elapsed time between the clock impulses and the actual opening or closing of the potential circuit may be a minimum and of constant value. Attention is called to the fact that the actual opening and closing of the meter potential circuit is controlled directly by the clock impulse, so that the cam setting need be accurate only to within a second to give standard clock accuracy to the timing of the meter.

The test table is fitted for both alternating-current and direct-current meters, and as several meters may be tested at once the capacity is much greater than that of the old method which used two men in place of one.

"Flats" on Collector Rings May Be Avoided

By W. E. Warner
Brentford, England

Revolving armature alternators and rotary converters sometimes give trouble through wear and the formation of "flats" on their slip rings. The wear is caused partly by mechanical abrasion of the brushes and partly by arcing or current transference of metal from the ring to the brushes. The wear due to abrasion is constant, but that due to the current varies around the ring, often leading to the formation of "flats." Where the current passes from the ring to the brushes the ring will present a bright surface due to the carrying of particles of metal from the ring to the brush, whereas along the surface where the current passes from the brush to the ring the latter will present a dark appearance and the wear will be much less.

To equalize the wear the connections to the rings may be changed over periodically so as to reverse the current flow from the brushes to the rings. But serious "flats" seem to be caused by the current being collected at an insufficient number of places. The remedy, therefore, is to increase the number of brushes around the ring to secure better current collection.

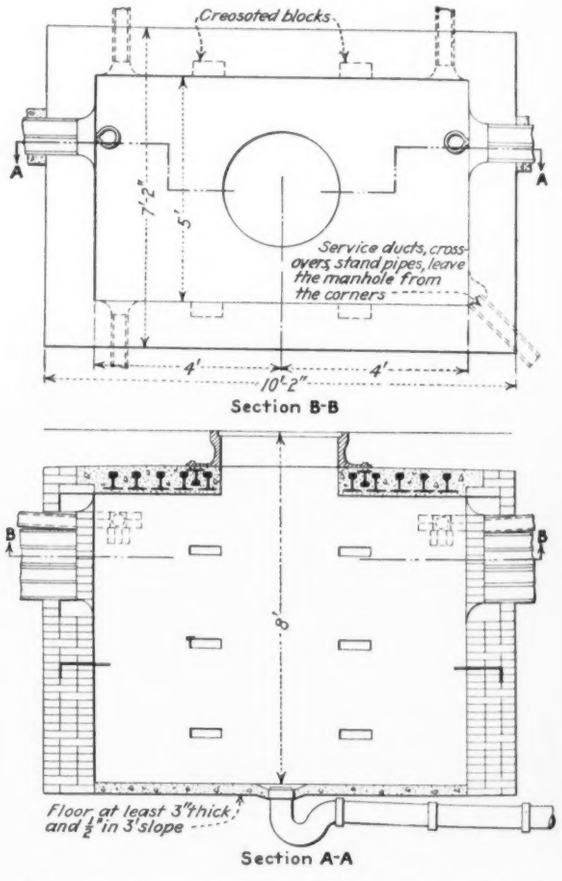
Contributory causes to the formation of "flats" are overheating of the ring or brushes, bad fitting of the brushes, a bad surface on the rings or lack of cleanliness. If any of these causes are present they should be removed.

Steel slip rings which are often used on alternators seem to be particularly liable to develop "flats." Their thermal conductivity is much lower than bronze rings and their contact drop is some 30 per cent greater. Furthermore, they tarnish rapidly, raising the contact drop. The tarnish forms when the machine is at rest, and as some parts of the ring are covered by the brushes the tarnish will not be uniformly distributed around the ring. This non-uniform tarnishing renders "flats" more liable to form.

Tarnishing can be reduced to a great extent by dressing the rings with paraffin as the machine comes to rest.

Cinder-Concrete Blocks for Manholes

Performance and economical results have been good in connection with the use by the Rochester Gas & Electric Company of cinder-concrete blocks instead of brick for manholes located under sidewalks



Utility Develops 5 x 8 x 8-Ft. Manhole for Cinder-Concrete Construction

or wherever they are not subjected to traffic loads. The blocks are cast in a size 8 x 8 x 16 in. Savings in material and labor cost have been found to average 15 per cent.

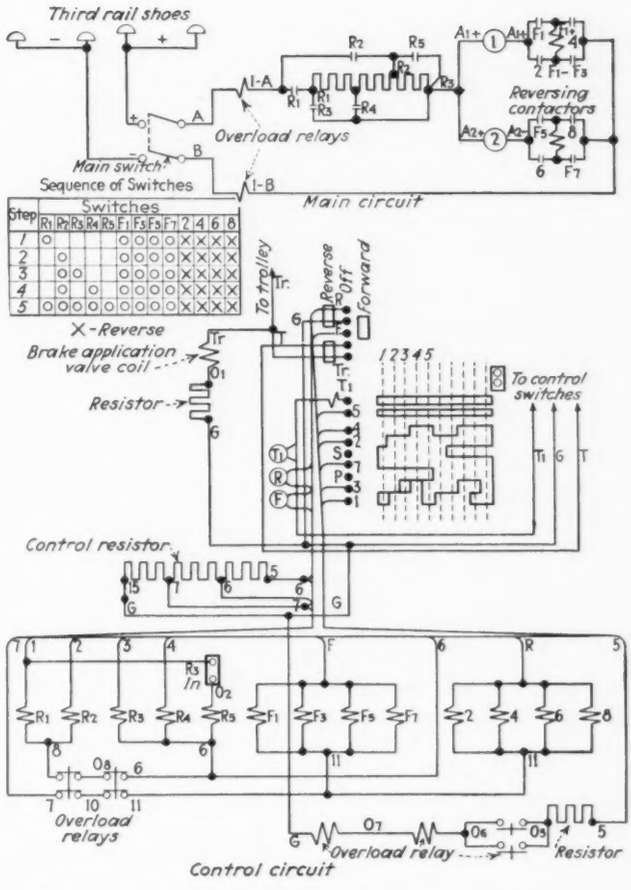
High-Speed Locomotive Increases Steel Mill Capacity

IN ORDER to increase the output capacity of a large blooming mill driven by a reversing steam engine at the Aliquippa (Pa.) Works of the Jones & Laughlin Steel Corporation it was necessary to install some means for rapidly delivering the hot ingots from the ten rows of soaking pits to the mill. This has been done by providing a specially designed Baldwin-Westinghouse 20-ton electric locomotive for this service. The locomotive has an accelerating speed of 2½ miles per hour per second, which means that in four seconds it has obtained a speed of 10 m.p.h., or an average speed of 5 m.p.h. The machine is loaded with an ingot from the soaking pit and rushes down the track, sometimes a distance of 500 ft., where the load is transferred to the approach table, while the locomotive returns to the pits. A complete trip, including stops and an eight-second standstill, requires 48 seconds. This is at the rate of 75 ingots per hour. In October, 1928, the mill turned out approximately 106,000 tons of steel, consisting of approximately 75 per cent 8-in. x 8-in. billets and 25 per cent of slabs and 12-in. x 12-in. blooms.

Forced Ventilation Raises Motor Ratings

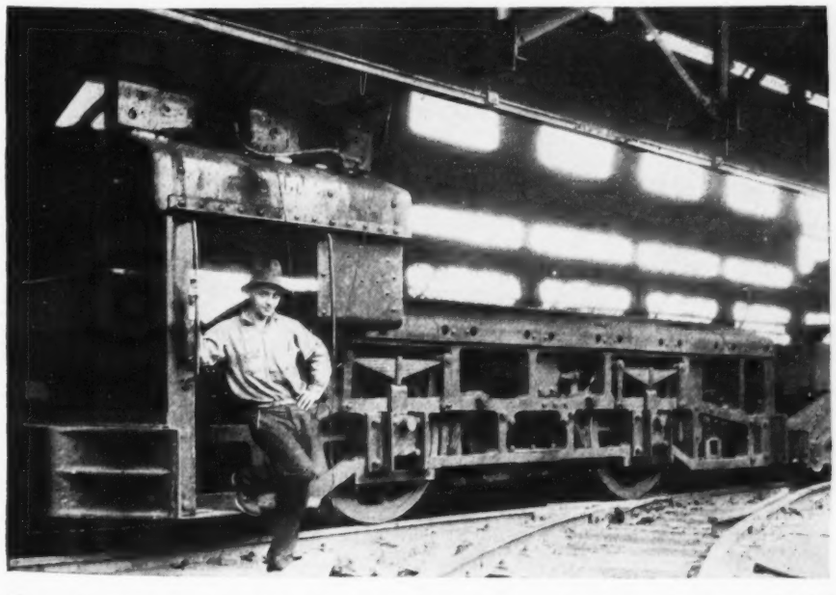
The locomotive, of the Baldwin-Westinghouse "Bar-steel" frame type, is equipped with two 150-hp. commutating-pole type traction motors, with single reduction helical gearing. Electro-pneumatic control for parallel operation of the motors is used. The application of forced ventilation to these traction motors increased the continuous rating approximately 120 per cent over the continuous current rating without forced ventilation.

The master controller on the locomotive is provided with two drums, a main or accelerating drum and a reverse drum, both of which interlock, so that the main drum must be in the "off" position before the reverse drum can be moved and the reverse drum must be in one of the operating positions before the main drum can be removed. Both the main and reverse drum handles control circuits only to the electro-pneumatic contactors, which are used to provide reversal of motors and to accelerate the locomotive. The contactors are electrically controlled, with each contactor independently closed by an air cylinder when its control circuit is energized, and when the magnet is de-energized the circuit is opened by a powerful spring on the release of the air, which is controlled by the magnet valve. Power is supplied from a 230-volt direct-current circuit to the locomotive to positive and negative underrunning third rail shoes.

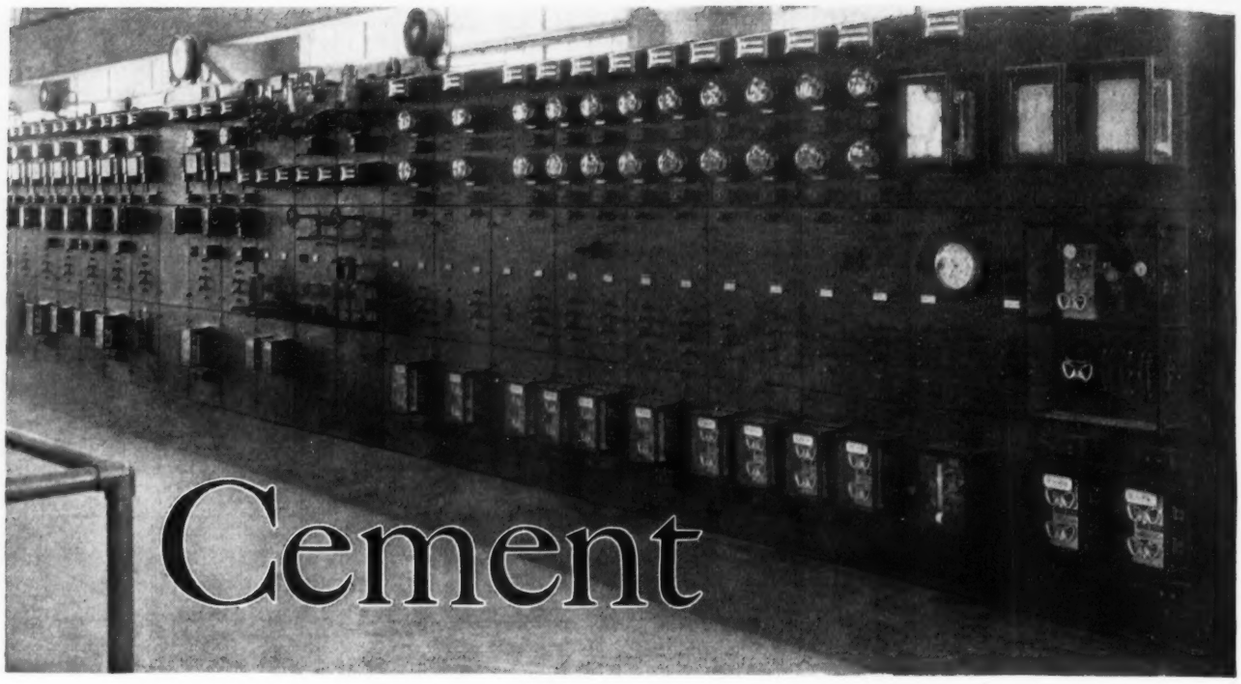


Electro-Pneumatic Control Permits High Locomotive Acceleration

Overload protection to the motors is provided by an overload relay, the operating coil of which is connected to the main circuit between a third rail shoe and the accelerating contactor. An overload relay is also placed in the negative side of the line between the negative and third rail and the contactors that are used for reversing the motors. The relay connections are made to provide at least two or more contactors to act as line switches. The relay may be adjusted over a reasonable range in current value and set for a predetermined current limit, and when this limit is reached will open those switches acting as line switches. The relay is reset by bringing the main drum handle to the "off" position.



Rapidly Accelerating Locomotive Boosts Output of Steel Mill



An Electrified Industry

All types of motors used. High power factor, high load factor and large energy user. Typical installations and controls

By R. H. Rogers
Industrial Engineering Department, General Electric Company

THE cement mill electrical load has a high load factor and high power factor and each mill uses a considerable quantity of power. The making of cement is a continuous process which must proceed night and day throughout the year; in fact, 23 months of continuous operation is not uncommon, with a brief shutdown for overhauling before starting another campaign. This, coupled with the fact that there are few motors not in continuous operation, makes the load factor equal to or better than that of any other industry. The use of synchronous motors for driving the large power-consuming units makes it possible and profitable for the mill to maintain unity power factor. The average plant produces in excess of 3,000 bbl. of cement per day and therefore requires something in the order of 45,000 kw.-hr. per day.

Outdoor substations are the rule, frequently owned by the power company and supplied usually by two high-tension circuits. Lightning arresters and disconnecting switches precede the transformers. The transformer secondaries connect to switch houses containing oil circuit breakers of sufficient capacity to interrupt any likely short-circuit inrush. There may be two or three 2,300-volt circuits to the mill with meters and disconnecting switches.

The use of power is largely concentrated in the "mill room," where the raw and finish ball mills are located, hence it is at this point that the main switchboard is located. The board may consist of about 24 panels for incoming lines, motor-generator set control, 2,300-volt power circuits, 450-volt power circuits and individual control panels for the ball mill motors. In the basement underneath the board are the oil circuit breakers and general switchgear, large auto-transformers or "compensators" and the 2,300/440-volt transformers for small motor power. Starting and running buses are provided for the large motors so that one compensator with spare serves all the motors that are not started on full voltage. Synchronous and induction motors of 500 hp. and less are almost always installed for full voltage starting and time delay overload and undervoltage trips are provided on all the principal motor controls to prevent shutdowns from momentary overloads or voltage dips.

The diverse characteristics of the motor loads in a cement mill make it necessary to use adjustable-speed, direct-current motors, wound-rotor induction motors, squirrel-cage induction motors and synchronous motors.

The 230-volt direct-current motors are used for kiln drives and for various types of materials feeders. Speeds are required to be adjustable by field control through a 2:1 or 3:1 range. Feeder motors are most often 5-hp. open type units. The control may be close to the motor, as for mill feeding of stone or clinker. The "Ferris wheel" feed that supplies slurry to the kiln is controlled

from the burning deck at the other end of the kiln and a story lower down. From control to motor may be more than 300 ft. The kiln motor may be rated 50 or 75 hp., and as the kiln revolves at from one-half to one revolution per minute much gearing is interposed. The control for the kiln motor is also on the burning deck, but usually not more than 150 ft. from the motor. Where the kiln is fired with pulverized coal the coal feed motor is a direct-current, adjustable-speed unit. The burner, therefore, has under speed control the slurry feed, the coal feed and the kiln rotation. The induction motors and direct-current motors for the burning department of a four-kiln mill require an imposing array of control devices.

Electric power shovels are indispensable in cement mill quarries and those subject to heavy work are almost sure to be operated on generator voltage control (Ward Leonard principle). On such shovels there is a synchronous motor-generator set with three direct-current generators, one each for the hoist motor, the swing motor and the crowd motor. The operation and reversals of the motors are controlled solely by the strength and polarity of the fields of their generators. This system of control by the generator voltage enables the shovel to do a tremendous amount of work in such a smooth way that maintenance is no longer a heavy item in shovel operation.

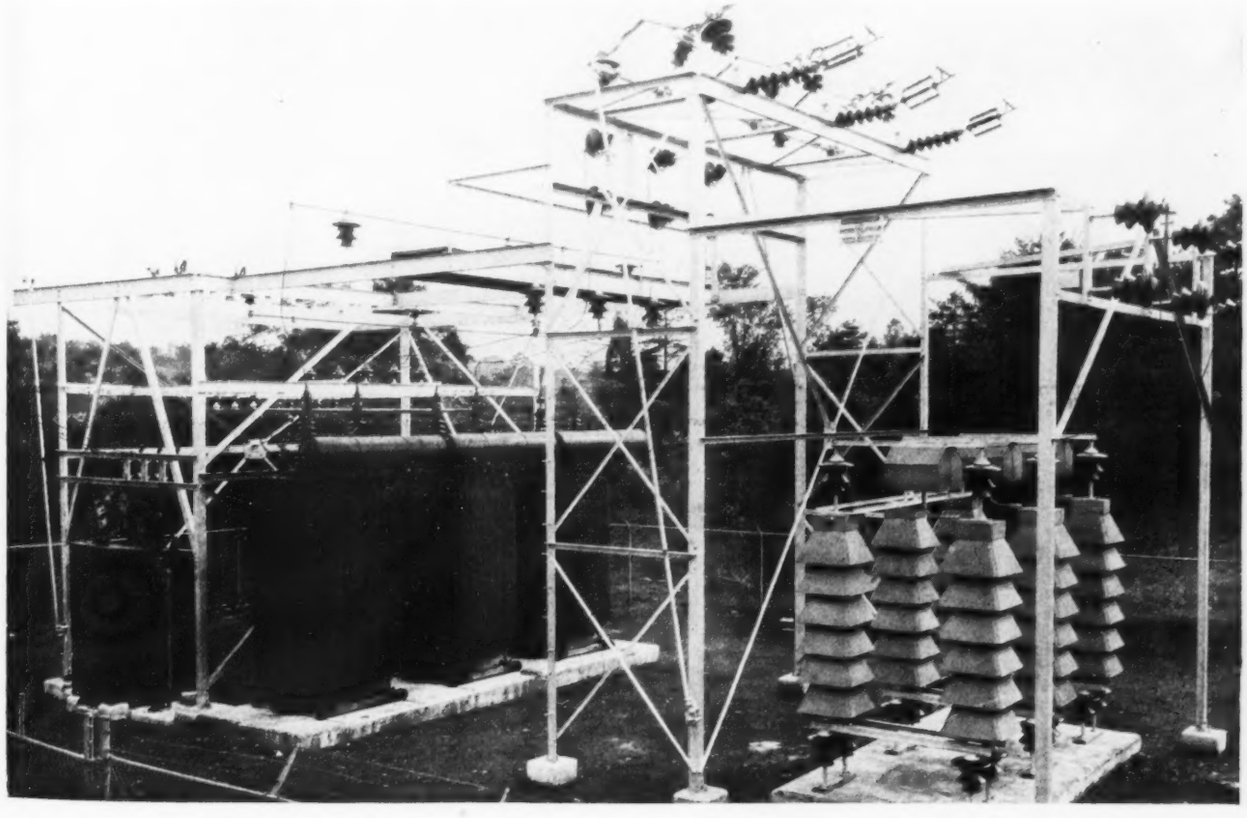
At some cement properties electric traction is used, and of course direct-current motors carry the burden. Self-propelled side dump cars, each hauling a dummy car, are used at one prominent plant.

Wound-rotor induction motors are used on such heavy duty as quarry slope hoists, rock crushers, hammer mills, and the like, where the current inrush to a squirrel-cage motor would be too great for full-voltage starting. These motors are also used for adjustable-varying-speed service, as for kiln drives by using constant-duty resistors in the secondary circuit. This type of motor and control is

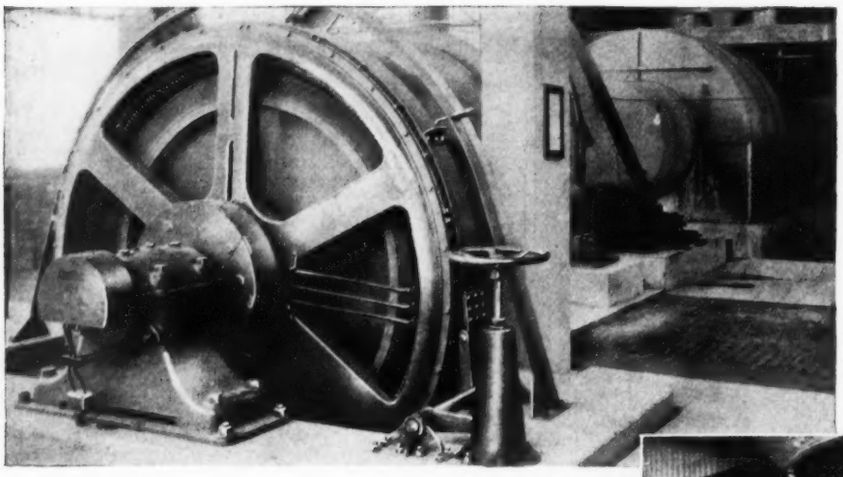
THE CEMENT MILLS of this country produced in 1928 176,000,000 bbl. of Portland cement worth $350,000,000. This cement, together with stone, sand and water, would make a concrete highway 72,000 miles long or three times around the earth.

All the power operations in cement mills are carried on by electric motors which require from 12 to 18 kw.-hr. per barrel of cement manufactured. The larger part of the 2,500,000,000 kw.-hr. thus required per year is purchased and, as this item is a substantial fraction of the production cost in a keenly competitive business, every effort is made to get the most out of a kilowatt-hour.

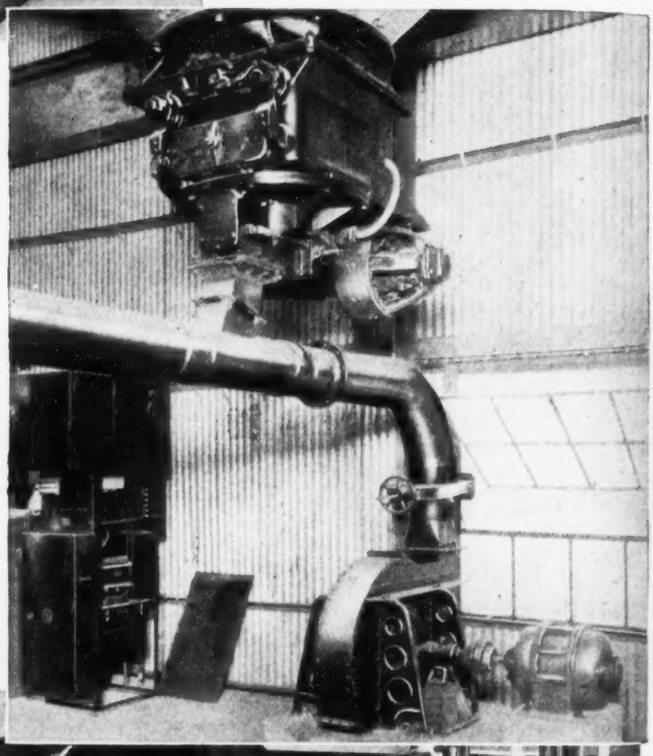
The modernization of old plants and the building of new plants are going on continuously, hence the industry presents a fertile field for improvements in the safeguarding, distribution, control and use of electric power.



A 3,000-Bbl. Mill Requires a Substation of About 3,750 Kva. Capacity. This One Is for 66,000/2,300 Volts and Is Owned by the Power Company



Proper Motorization Makes for Clean, Orderly Plant

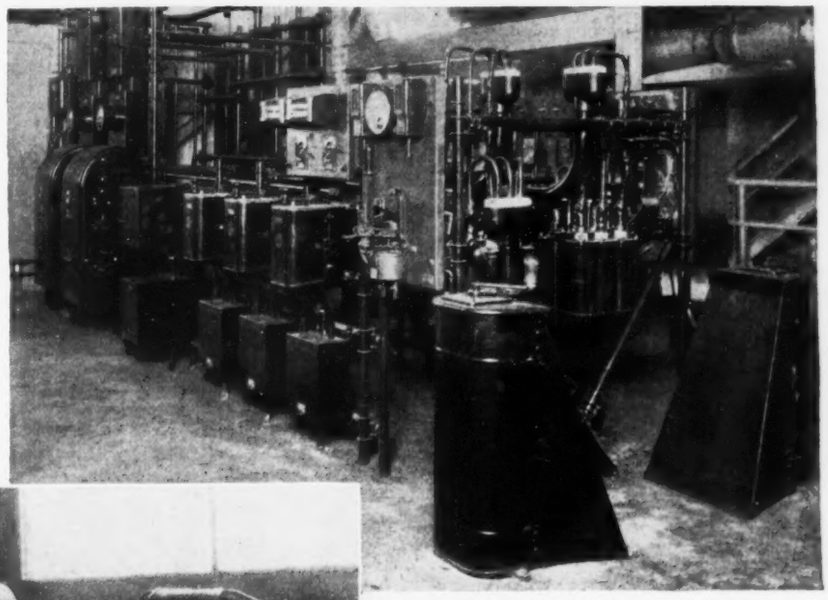


Above — An 800-hp. super-synchronous motor driving a 40-ft. raw grinding mill. The brake is handset in this installation.

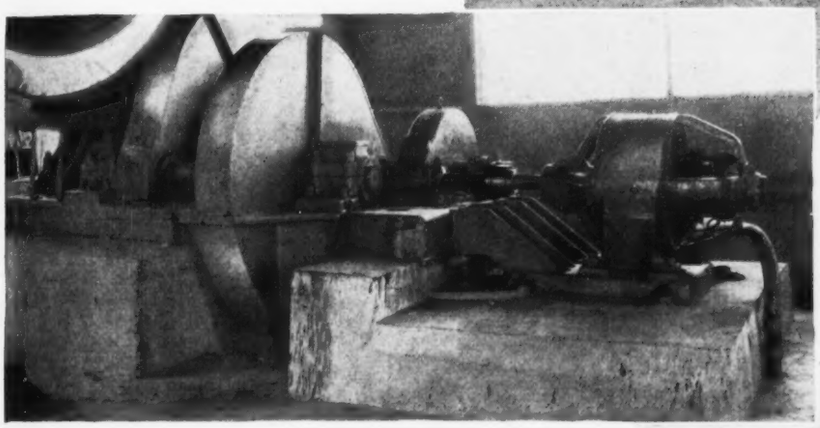
Center—Primary air blast with alternating-current motor and pulverized coal feeder with direct-current motor for a kiln. With 75 per cent secondary air at 550 deg., the combustion of powdered coal holds the interior of the giant kiln to 2,900 deg.

Below—Part of the switchgear in basement under the switchboard of a cement mill. Light, neat, roomy installations of this kind mark cement mill installations.

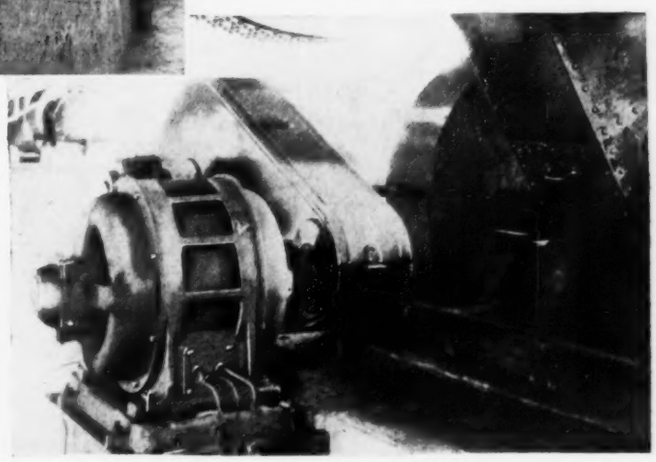
sometimes used on crusher feeders between hopper and crusher or between the primary and secondary crushers. In such cases the load on the constant speed mill ahead of it is controlled by the speed of the conveyor. Large motors of this type are operated from the 2,300-volt power circuits, while the small ones are connected to 440-volt circuits. Squirrel-cage motors of two types are used. The normal-reactance, single-squirrel-cage motors greatly predominate, for they are applied to pumps (for water, slurry and cement), screw feeders, conveyors, fans, agitators and other general-purpose duties. The high-reactance, double-squirrel-cage motors are used on hard starting loads that do not require a wound-rotor induction motor. They may drive vertical or inclined conveyors, clinker coolers, agitator bridge motion and in some cases the kilns. These motors have high starting torque with moderate inrush of starting current; otherwise they act as normal squirrel-cage motors. The squirrel-cage motors are nearly always started by magnetic line switches, push button actuated.



Group of Burning Deck Controls for Kilns, Coolers, Dampers, Coal Feeders, Slurry Feeders, Etc.



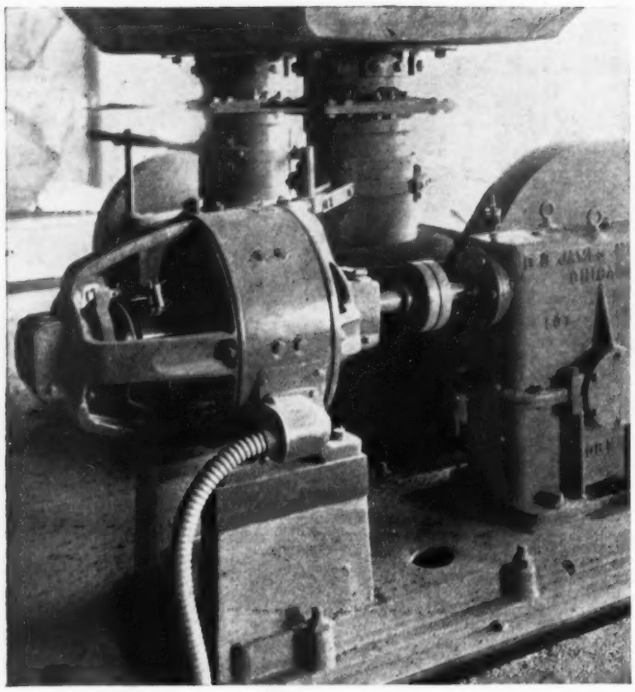
High-Reactance, High-Torque, Squirrel-Cage Motors Geared to a 400-Ton Kiln Turning at 1 R.p.M.



This Kiln Drive Is Controlled from the Burning Deck 150 Ft. Distant

The greater part of the power in a cement mill is applied through synchronous motors. Normal-starting-torque synchronous motors are applied on motor-generator sets for furnishing excitation current for synchronous motors and power for the direct-current motors. Two or three such sets are installed, and if direct-current kiln motors and direct-current traction are used they must be of large capacity. An interesting installation uses such a set for maintaining unity power factor in the plant by automatically regulating the motor field excitation on the principal synchronous motors at the behest of the power factor meter. Synchronous motor-driven air compressors from 75 to 250 hp. and from two to five units supply air at 100 lb. pressure for general purposes and for operating the cement pumps (pneumatic), while air at a lower pressure is furnished for agitating slurry in the blending, regulating and storage tanks. Compressor motors in cement mills are started on full voltage, but with the compressor unloading valves open.

The ball mills, huge revolving cylinders each containing perhaps 100 tons of hard steel balls or pellets, require 400- to 900-hp. motors to drive them at twenty revolutions per minute. The starting duty is severe, as the excessive weight, 160 tons, sometimes causes high bearing friction after a shutdown. The motor load for the first few revolutions is from 125 per cent to 180 per cent normal because the charge has to be raised as a mass.



Adjustable Speed D.C. Motor Feeding Clinker and Gypsum to a Finish Grinding Mill

When cascading starts the load falls to normal. The supersynchronous motor was developed for this duty. It has a stator mounted on trunnion bearings and is surrounded by a band brake. With the brake released, the stator is started and brought into synchronism while the rotor and its load are standing still. Now the normal pull-out torque of the motor is available for starting. The brake is gradually applied and as the stator slows down the rotor must start and speed up to maintain synchronism between the two. The sum of the stator and rotor speeds is synchronous speed. After from ten to twenty seconds, as dictated by the maximum amount of inrush current that is acceptable, the stator is brought to rest and the motor thereafter performs as a normal synchronous unit. The brake may be applied by hand or by a direct-connected pilot motor which operates at a predetermined rate. These motors may be unity, 0.90 or 0.80 leading power factor machines as needed to insure unity power factor for the plant. These large motors are generally started from a reduced voltage bus energized through an auto-transformer or "compensator."

High-torque synchronous motors are being applied to ball mills with good results where the power system is adequate to stand the inrush incident to eight- to ten-second starting. These high-torque synchronous motors have double-squirrel-cage or amortisseur windings, which affect the starting torque and starting current just as the same construction affects a squirrel-cage induction motor. This type of motor presents the simplest form of synchronous motor drive for hard starting loads as it requires no clutch or other unloading device.

Ball mill motor speed is usually such that a single spur-gear reduction gives 20 r.p.m. to the mill. Synchronous motors can be designed for low-speed operation without sacrificing any of their other desirable qualities, and this fact, coupled with extremely high efficiency, makes them the universal choice for raw and finish grinding mill drives.

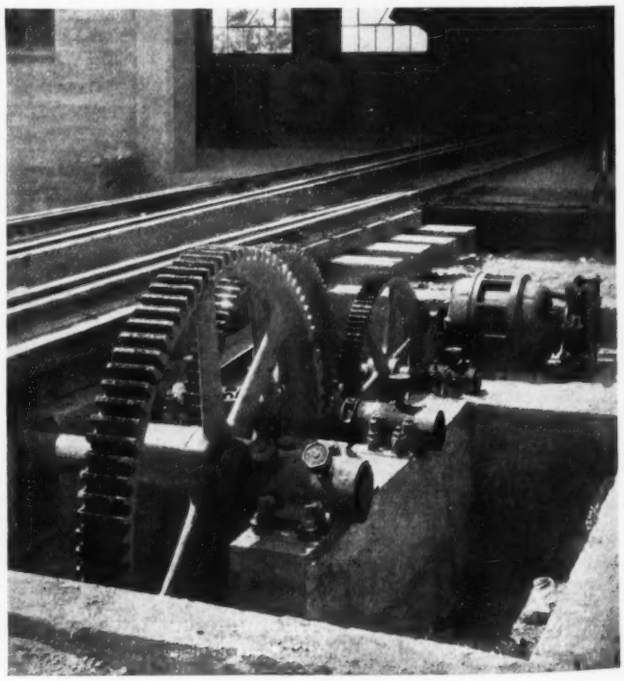
A 3,600-bbl.-per-day cement mill will have about 6,500 hp. in motor nameplate ratings, of which perhaps 3,000 hp. will be in induction motors and 3,500 in synchronous motors. The induction motors in a modern mill are fairly high-speed units carrying nearly full load, hence the power factor of this division will be about 0.82 to 0.85. The synchronous motor load being greater, some of the motors can be unity power factor and others 0.90 and 0.80 leading power factor, to give from 0.90 to unity power factor for the plant as a whole. A common practice is to make all the smaller synchronous motors unity power factor and four 600-hp. units 0.9 leading. For example:

3,000 hp. at 0.82 lagging power factor
1,000 hp. at unity power factor
2,400 hp. at 0.90 leading power factor gives a plant power factor of 0.97

Demand Usually Limited

A system of automatic demand limitation is in use in the cement industry. It has two functions, viz., to limit peaks of short duration and to reduce loads after a twelve- to thirteen-minute excessive demand so as not to exceed the fifteen-minute contract limit. Magnetic unloading valves are installed on the compressors so that the compressors in succession in predetermined order are unloaded until the peak passes, when they are reloaded in reverse order. If any one compressor is shut down for any other purpose its number is automatically skipped in the sequence. When the demand begins to threaten the fifteen-minute limit the system shuts down one ball mill motor and then a second one if necessary. These motors do not restart except under control.

With automatic unity power factor, the highest industrial load factor and automatic peak and demand limit, the modern cement mill is an ideal application for electrical power.



Motor Handles Cars with Raw Materials

A 15-hp. high-torque, double-squirrel-cage motor which hauls six 8-ton loads of rock and six cars past the hopper. It is equipped with a solenoid brake for spotting the cars.

Letters from Our Readers

Brooklyn Citizen's Viewpoint on Submetering

To the Editor of the ELECTRICAL WORLD:

I have read with interest the article entitled "Submetering—A Menace," published in the October 19 issue of the ELECTRICAL WORLD. The article is interesting, but beyond a certain point it fails to carry conviction. As presented to most people, the facts are as follows:

1. The utility company charges the large consumer a comparatively low price. It must be granted that this price is fair. It is the price requested by the utility company so that it must yield a satisfactory profit. It is approved by the authorities so that the profit should not be exorbitant.

2. The utility company charges the small consumer a higher price. The cost of servicing the small consumer is as great as that of servicing the large consumer, so that the cost of electricity per unit is higher. This price also is justified by authority.

3. The apartment house owner takes advantage of the two prices. He purchases the electricity at the price approved for the large consumer, and he sells it at the price accepted for the small consumer. It is only in the exceptional case that he charges more. This statement is the nub of the whole argument, but I believe that it is correct.

If these three statements are correct, it is difficult to see that the hardships are more than minor. The utility company is freed from the expensive work of servicing the small consumer and this work is carried by the one who can do it more cheaply, the man on the premises, the landlord. The argument that the utility company is thereby deprived of a large profit opens the way to the conclusion that the charges to the small consumer are exorbitant.

Would not the whole question be solved by the enactment of a law assuring to all consumers purchasing the same amount of energy the same prices, the same safeguards regarding meter testing, etc., regardless of whether they buy from their landlords or from the utility company?

According to the papers, if submetering were stopped the utility company would divide with the public the additional profits which it would receive therefrom. Such a statement reaches very sympathetic public ears. However, it prompts the question: What proportion does the amount of energy sold through submeters bear to the amount of energy sold direct to the small consumer? It is natural to believe that the proportion is small and that the sales direct to the consumer are several times greater than the sales to the landlords and other submetering companies, that the "unjust" profits to the submeters are only a small proportion of similar profits to the utility company.

If the utility company is moved by sympathy for the small user, if in addition it wishes to eliminate submetering, there is no better way to achieve both aims than to reduce the price to the small consumer to the lowest figure that would yield a reasonable profit. In this way the charitable purpose may be achieved. If this is done the pressure of public opinion will be so strong that the submeterer will be forced to reduce his price and the "unjust" fourteen million dollars will disappear.

185 82d Street,
Brooklyn, N. Y. J. N. DODD.

Buried Cable Extensively Used in Europe

To the Editor of the ELECTRICAL WORLD:

I have read with interest the article by F. E. Smith on "Economy of Buried Cable," in the October 19 issue of the ELECTRICAL WORLD. The practice of using armored cable of the type described by Mr. Smith, buried directly underground without conduit, has long been in extensive use in Europe. I am speaking of those parts of Europe with which I am best acquainted as regards electrical engineering practice; that is, the countries following German practice. The trench is filled with a few inches of sand, on which the cable is laid, and covered with another layer of sand, on which usually one layer of special large brick is laid, dry. Where low cost is desired and conditions warrant it the bricks may be left out. Thus I have laid several miles of armored high-tension cable in central Africa where the cable was only covered with wire netting of about 1 in. or 1½ in. width of meshes, buried a few inches above the cable to caution workmen when digging up the ground in subsequent operations as they come near the buried cable.

There are many other instances in which the same engineering problem finds different solutions in Europe than in America, each used in its territory more or less to the exclusion of the other and apparently without any difference in local conditions to justify the diversity in practice.

For example, there is the short-circuit brake for trolley cars, which is hardly, if ever, used in this country except as an emergency brake; the extensive use of the sliding contact in Europe instead of the trolley wheel, and the riveting of steel bridges into the rigid structure instead of the use of eyebars, as in this country.

Even some engineering theories are different; if I remember correctly, when I was in school, belt transmissions were calculated in America on the theory of air pressing the belt against a vacuum created between belt and pulley, whereas the European theory took into account only the friction caused by the tension of the belt.

111 South Ninth Street,
Mount Vernon, N. Y. H. E. EISENMENGER.

Illumination Intensities

To the Editor of the ELECTRICAL WORLD:

The very interesting letter of Norman Macbeth in the October 5 issue of the ELECTRICAL WORLD offers a great many sound and practical ideas. It might even be termed an excellent summary of the present status of the art of lighting. It only goes to prove, however, that the suggestions made in your editorial concerning the vagueness and indefiniteness of the opinions on intensities of illumination make it preferable to give minimum values only. Mr. Macbeth may perhaps be too pessimistic about the possibility of the substitution of the foot-lambert for the foot-candle or, as he expresses it, "how could the user of a Franklin specification interpret a foot-lambert?" It was, of course, just as difficult for this same user to interpret a foot-candle before Mr. Macbeth invented his illuminometer. Perhaps Mr. Macbeth or some one else may some day invent a practical foot-lambert meter and then the substitution of the foot-lambert for the foot-candle will follow as a natural sequence. It would be well, however, even now, for illuminating engineers to begin to think and to talk more in terms of foot-lamberts.

C. O. VON DANNENBERG.
Electric Management & Engineering Corporation,
New York.

Digest of Foreign Literature

Hydro-Electric Development and Steam Equipment

Smoke Abatement in Hamburg.—Investigations covering a number of years have been made in Germany in order to determine both the characteristics of objectionable materials released to the atmosphere and methods for minimizing the difficulties. Of particular interest are the references to the ash content of coal and to the release of sulphur in combustion processes. No specific recommendations of tangible value for minimizing the release of fly ash have been made.—*Engineer (England)*, October 18, 1929.

Generation, Control, Switching and Protection

Design of Low-Tension Switchgear.—W. Wilson.—Low-tension switchgear forms, according to the author, a natural starting point for a consideration of the design of switchgear generally, since the various factors that enter into the question differ only in degree when passing from one voltage to another. The principles involved are the same for all potentials, but they are seen in their simplest form in connection with the lower values, becoming more complex when high-voltage currents have to be controlled. Accordingly, the various factors have been taken up in succession, including current carrying capacity, rupturing capacity, design of conducting surfaces of the radial arm, knife pattern, drum and finger, wedge type, horn type, laminated type and "V" type, the design of current-breaking elements and a consideration of the various mechanical effects. Formulas have been developed for design and analytical purposes and the certain fundamental features evaluated.—*World Power (England)*, October, 1929.

Transmission, Substations and Distribution

Large Induction Voltage Regulators.—M. Liwschitz.—In spite of the growing competition offered by load ratio control transformers, induction voltage regulators are constantly gaining ground in Europe. Two inherent advantages account for the preference given the regulator. Its gradual voltage change becomes a necessity when rotary converters or mercury-arc rectifiers are to be controlled. Its much higher reactance limits short-circuit currents in power systems. Since the series winding of a regulator lies directly in the line, its winding must be specially protected against over-currents and the mechanical results therefrom, heavily reinforced coil heads guard against dynamic displacements. The worm wheel which turns the rotor is not rigidly keyed to the shaft, but is connected to it over a carefully gaged shear-pin, which breaks at about five times normal torque. A protection against excess voltages is obtained by shunting the series winding with condensers.—*Siemens Zeitschrift*, September, 1929.

Illumination

Gala Illumination of Prague (Bohemia.)—H. Seeman.—To celebrate the tenth anniversary of the Czechoslovakian Republic, the capital, Prague, staged an elaborate municipal floodlighting of its public buildings, to which was added the lighting of a great many private mansions. The city installed 220 parabolic reflector lamps of 500 to 2,000 watts, totaling, with the private load, 1,300 kw., and consuming during the festivities about 100,000 kw.-hr. Particularly effective was the lighting of the old castle Hradschin, with a frontage of 1,900 ft., reflecting its image to the River Moldau. Several other famous towers and cathedrals of the old city, such as the Pulver Turm, Nikolas Church, etc., were lighted.—*Revue Générale de l'Electricité*, September 14, 1929.

Elements of Good Factory Lighting.—D. Winton Thorpe.—The author has endeavored to establish the actual desiderata of good lighting for industrial plants and has illustrated with selective care certain adequate installations in various industries. A number of interesting points have been brought out in the discussion regarding misconceptions on this subject and the author concludes that it is of the utmost importance that illuminating engineers give their clients to understand that the science of good lighting does not begin and end with the plan layout of lighting points, but that the height of each point above the working plane is the key to the whole situation. It is stated that the author recently carried out an elaborate scheme of lighting which had been duly approved and put into execution, but in which a change was made at the plant of the client and the entire lighting job was spoiled. This article has been confined largely to the consideration of the relation of good effective lighting to efficiency and production. In addition to all this it is pointed out that there is an equally important aspect relating to the prevention of accidents, etc.—*World Power (England)*, October, 1929.

Heat Applications and Material Handling

Electric Cooking Load.—While it is estimated that more than 100,000 households cook solely or partly by electricity in Switzerland, engineers of that country have reached the conclusion that in order to electrify the kitchen satisfactorily on a large scale the short-period energy consumption of the electric cooking stove with its high loading of short-duration must be converted into a demand uniformly distributed over the 24 hours and without a peak. An electric range working on a new principle with a maximum energy consumption of 450 to 600 watts may be connected to a lighting circuit. The device is dependent upon air circulation produced by a small fan withdrawing heat from a reservoir consisting of a cast-iron core with electric heating element for its operation, the whole cooking unit being surrounded by a quantity of sand which acts as a heat-insulating medium. A water heater is included in the unit arrangement. The heat stored in the cast-iron element and by the sand is taken up by air which penetrates into the sand on all sides and which passes toward the central casing and then flows to the various cooking points. A very high efficiency is claimed for this device and satisfactory cooking results are said to have been obtained. It is stated that with a 400-watt loading for twenty hours the stove requires but 15 per cent more energy than a directly heated cooking stove designed for the same cooking and water heating duties.—*Engineer (England)*, October 11, 1929.

Telegraphy, Telephony, Radio and Signals

Simplified Picture Transmission.—H. Bucek.—The electro-photographic methods of picture transmission, which are widely used commercially, are too complex to lend themselves to amateur reception. An Austrian concern has developed a simplified system, primarily intended for use in the home, by means of which any radio amateur is able to receive $3\frac{1}{4}$x$4\frac{1}{4}$ size pictures, broadcast by a station. To send the image requires the preparation of a carbon process print upon a copper foil, using a line screen in copying. The foil is then placed on a cylinder, turned at constant speed, and a metallic stylus, describing a close spiral over the picture, causes a sequence of impulses to be admitted by the antenna. At the receiving station a simple phonograph spring motor turns a similar cylinder, upon the surface of which is placed a wetted sheet of paper, impregnated with iodine-potassium. A metal stylus, carried along the cylinder by a threaded spindle, receives the impulses, and by a discoloring of the chemical in the paper traces out the transmitted pictures. A simple synchronizing arrangement, acting at every turn of the cylinder, keeps the receiver in perfect step with the sender. The given size of picture may be transmitted within 3.8 minutes.—*Elektrotechnik und Maschinenbau*, September 22, 1929.

News of the Industry

Pennsylvania to Order 150 Electric Locomotives

To Be Completed in Two Years, These Engines Will Be Used for Passenger Service on New York-Washington Main Line

ELECTRIC locomotives to the number of 150, said to be of greater speed and unit power than any previously manufactured, are to be ordered by the Pennsylvania Railroad for its main-line electrification from New York to Washington. The reported cost will be $16,000,000. The order may be placed early next year, though the final engine will probably not be completed before two years. Specifications that may be completed by the end of the year are being drawn by engineers of the Pennsylvania Railroad, of the Westinghouse Electric & Manufacturing Company and of the General Electric Company.

The locomotives will have a maximum speed of at least 90 miles an hour. They will have a capacity of 6,000 hp. when used in pairs, compared with the 4,000-hp. rating under which the large Pennsylvania locomotives now operate. With these locomotives the Pennsylvania could cut the running time between New York and Washington from about five to four hours or less and reduce the time of two hours between New York and Philadelphia to one and one-half hours.

Utility Investigation Likely to Be Resumed Soon

With Robert E. Healy, chief counsel of the Federal Trade Commission, back in his office after a long illness, it is expected that the commission soon will fix the date for resumption of hearings in the public utility investigation. Under the prearranged program the public utility companies will have an opportunity to rebut the testimony produced by the commission concerning allegedly improper propaganda activities before the investigation proceeds to the financial aspects of their business.

Electrical Executives Join in Presidential Conference

The second of the conferences called by President Hoover to further his endeavors to stabilize the business of the country assembled at Washington on Thursday. It consisted of the executive heads of leading industrial, mechandising and utility organizations. Among the 22 men who were to meet the President and Secretaries Mellon and Lamont were such prominent business men as Henry Ford, Julius Rosenwald, Julius Barnes and William Butterworth. Electrical and utility interests were to be represented by Owen D. Young, A. W. Robertson, Matthew S. Sloan and Walter S. Gifford.

Wilbur and His Aids Restudy Boulder Dam Plans

Secretary of the Interior R. L. Wilbur and officials of the Reclamation Service are studying the figures and arguments submitted at hearings on protests against the tentative allocation of Boulder Dam power which were reported last week. The three principal plans which have been discussed and which are now before the Department of the Interior for study are:

First, the tentative plan of the Secretary of the Interior involving the operation of the Boulder Dam power plant by a board in control composed of two representatives appointed by the publicly owned utilities of southern California, two appointed by the public utility corporations and one appointed by the government. This plan was printed in the ELECTRICAL WORLD for October 26.

Second, a plan urged by the publicly owned agencies under which the government would install the machinery in the power house and both the plant and transmission lines would be operated by the Los Angeles Power Bureau.

Third, a plan submitted by the utility companies under which the machinery would be installed by the Southern California Edison Company and the power for distribution in southern California purchased and distributed by that company under government regulation.

None of these plans satisfies Arizona, Nevada or (as regards the proposed charges) Utah.

A telegram sent by Secretary Wilbur to Governor John C. Phillips of Arizona in reply to the statement from Arizona reported last week (page 994) concluded: "Applications for power from western Arizona by municipalities and mining companies indicate a demand for a large amount of power at the rate fixed. The allocation plan for the withdrawal of this power by the states is regarded as being beneficial to all concerned since it allows the states of Nevada and Arizona a reasonable time to ascertain their needs and contract accordingly, permitting the work to proceed meanwhile. It is not believed therefore that any better financial arrangements can be made or are justified by the conditions under which these works are to be built and operated."

To this Governor Phillips replied by a reiteration of Arizona's stand.

U. S. Navy Comes to Aid of Seattle and Tacoma

Department Orders the "Lexington" to Tie Its Power Plant in with That of Latter City to Meet Shortage Due to Drought

ALARMED by the shortage of electric power caused by unusually low water in the storage reservoirs on their respective municipal power systems, the cities of Tacoma and Seattle, Wash., on November 18 requested the navy to lend the electrically driven airplane carrier *Lexington* to supply the deficiency. Under the plan proposed the *Lexington* will be anchored in Tacoma Harbor and its power plant tied in with the local distribution system, which in turn can be tied in with the Seattle system.

It was at first reported that the navy had denied the request on the ground that the frequency of the ship's generators is only 50 cycles while that of the municipal generators is 60 cycles. A later dispatch, however, says that, after Seattle and Tacoma had petitioned President Hoover, the Navy Department rescinded its refusal and that government and power officials were conferring at Bremerton. The *Lexington*, which is lying in Puget Sound near Seattle, can generate more than 180,000 hp.

A grave situation confronts both the cities. Although the normal rainfall for Seattle is approximately 34 in. per year, since the first of this year the deficit has been 11 inches, so that streams show the lowest flow on record at this time. Full hydro capacity for western Washington is 329,500 kw. and steam capacity is 116,000 kw., but under present conditions the peaks carried by the hydro stations amount to 190,000 kw. and those by steam to 114,000 kw.

Cold weather and drought have so reduced the Tacoma hydro supply from the Cascade Mountains and the supply from the Olympia Range through the Cushman plant that city officials have announced that rationing of power to customers within city limits will begin this week and that all customers outside city limits will be cut off at once. It is reported that the present river flow has reduced the 54,500 kw. rated capacity of Seattle's Skagit plant to 15,000 kw. and that the Cedar River plant, of 40,000 kw. capacity, has been so reduced that only by making use of small pondage can it carry a peak of 8,000 kw. The Lake Union steam plant has a capacity of 30,000 kw., but it is reported as carrying 10,000 kw. overload continuously. Despite the foregoing, Seattle continues to supply its customers beyond the city limits, but the two cities have discontinued helping each other by interchange of power. Commenting on

the situation, R. M. Boykin, manager Puget Sound Power & Light Company, Seattle, said:

"The Puget Sound company, experiencing a shortage of water a year ago, built a 40,000-kw. steam station, giving it 72,000 kw. of steam capacity to care for such an emergency. We are in no danger as yet as far as peak capacity and output are concerned and are in a position to render service to such customers as Tacoma and Seattle may drop."

Hadley and Attwill Talk on Regulation

President Emeritus of Yale Tells New York Investigating Commission that Utilities Should Themselves Initiate Rates—Massachusetts Chairman Defends Bay State Method

WITNESSES from other commonwealths were the feature this week at the hearings of the New York legislative commission which is investigating the public service law of that state. Among those testifying were Dr. Arthur T. Hadley, president emeritus of Yale University; Thomas J. Tingley, formerly people's counsel for the Maryland Public Service Commission; Henry C. Attwill, chairman, and Louis Goldberg, member, Massachusetts Department of Public Utilities.

It was Dr. Hadley's contention at the Tuesday hearing in New York City that the Fink-Adams theory of rate fixing, in vogue in the early days of utilities, was essentially correct, and he argued that corporations should be permitted to initiate their own rates, stating that the interest of the public and of the stockholders in the utilities was substantially identical, since the companies made their greatest profits by charging low rates to the consumers. Rates established upon value of service rather than by figuring from a cost basis were urged by Dr. Hadley, who pointed to the reductions made in the past decade or so and insisted that they were voluntary ones.

Mr. Tingley viewed as unfortunate any necessity which made the Public Service Commission serve both in a judicial capacity and as prosecutor. The value, as demonstrated in Maryland, of the post of people's counsel to represent efficiently the cases of complaining customers was sustained by him.

Unqualified disapproval of "replacement-value-less-observed-depreciation" rate-making bases was expressed by Messrs. Attwill and Goldberg of the Massachusetts commission on Wednesday. The prudent-investment rate base and the premium law employed in Massachusetts were explained as to both principle and operation. A scathing and unqualified denunciation of the attempts and evidence introduced to establish the replacement value rate basis by the utility companies in the recent Worcester and Cambridge cases was made by both witnesses.

Chairman Attwill, in explaining the policies of his commission, stated that in establishing rate bases valuations did not, except where forced in by the utilities, receive any consideration, the whole endeavor being to consider the amount of money (par value plus premiums) actually paid in to the corporation by the stock owners. Stock-offering prices are regulated by the commission. The fundamental basis in Massachusetts is a fair and adequate return to the stockholder on the aggregate amount actually paid in since the company's organization.

In reply to a question as to the feeling of the public in his state toward the commission, Mr. Attwill expressed lack of information, saying that at one time the public and press could be favorable and at another antagonistic. "Any one who takes into consideration popularity with the public," he added, "is unfit to be a commissioner." Rates in Massachusetts at the present time are, he testified, substantially satisfactory to all. Standardized rates throughout the state are viewed as a virtual impossibility. Power rates are not considered by the commission, since the ability of industries to supply their own power insures the lowest competitive rates. "The next important field of activity for us," said the commissioner, "is efficient regulation in the case of small power users."

Commissioner Goldberg was questioned as to the fundamentals of rate making in Massachusetts and was firm in his opinion that the ruling of the United States Supreme Court in regard to "reproduction cost new less observed depreciation" had been overemphasized, largely through utility company publicity and efforts, since it was cited as *a* factor to be considered and not *the* factor. "Insistence upon the reproduction-cost theory would mean the end of effective regulation," said Commissioner Goldberg. "A damnable part of the reproduction theory is that engineering and economic progress is lost sight of."

Speaking of the Worcester rate case, Mr. Goldberg said: "This company had an unbroken dividend record of 40 years and in the six years prior to the rate case paid back in dividends three-quarters of the total subscribed by stockholders since its formation, yet the difference between a 7-cent rate and a 5-cent one was viewed by the company as confiscatory. This is a splendid example of confiscation." Because of the efficient and judicious management which the company enjoyed and other elements from which the public benefited previous to the company's purchase by the interests seeking a reproduction basis it was considered that 14 per cent on the $4,000,000 paid in would not be excessive. It was on this that the 5-cent rate was based. Chairman Knight pointed out that this was about 7 per cent on the conceded property value.

A lack of complete harmony between the political appointees on the legislative commission and the appointees of Governor Roosevelt was apparent at the session on November 14, when Public Service Commissioner George R. Van Namee continued to give testimony. Assemblyman Stone accused Professor Bonbright of wasting time, and Senator Knight, the chairman, criticised the line of questioning pursued by Frank P. Walsh.

A subject taken up was a petition made in 1927 to compel the Long Island Lighting Company to reduce its rates, alleged to give it a return of 14 per cent, which subsequently became still greater. The petition was invalidated by the withdrawal of signatures till those remaining were below the legal number. Mr. Walsh held that the Public Service Commission should then have pursued an investigation on its own initiative. It was not until this year that the company's rates were reduced, this reduction being voluntary.

A session of the investigating commission on Monday, November 18, was taken up with a discussion of the transit situation in New York City.

Hearings were continued on Thursday, November 22, with Commissioner Goldberg still on the stand.

Seek Dignitaries' Aid for Berlin Conference

President von Hindenburg of Germany has accepted the invitation of the World Power Conference to become honorary president of the quadrennial convention which is to be held next summer in Berlin, Henry K. Pierce of New York, vice-chairman of the American section of the conference, announces.

Mr. Pierce has requested President Hoover to become honorary chairman of the American committee, and the President has the request under advisement. Mr. Pierce says that four thousand power men, including four hundred from the United States, will attend.

U.G.I. to Spend $36,000,000 on Electric Subsidiaries

Almost $41,000,000 will be spent for expansion by electric and gas companies in the United Gas Improvement Company's system next year, President John E. Zimmermann announced this week. This is about $6,500,000 above the appropriations for 1929. More than $36,000,000 of this sum will be expended on light and power subsidiaries, these appropriations including: Philadelphia Electric Company, $26,400,000; Connecticut Light & Power Company, $6,000,000; Delaware Power & Light Company, $2,862,000; Luzerne County (Pa.) Gas & Electric Corporation, $501,000; Erie County (Pa.) Electric Company, $234,000, and Chester County (Pa.) Light & Power Company, $76,000.

Progress of Rural Service in Southeastern States

The standard rural electrification plan recently prepared by the Virginia Commission on Rural Electrification has been accepted by a large percentage of the power companies of the state. It provides machinery whereby rural consumers may procure extensions by paying a minimum periodical rate for power, this minimum rate providing assurance that the capital charges of the extension will be recovered by the company within a reasonable time. The plan provides that each consumer shall wire his own property, but many companies, it is reported, can furnish additional service on a partial-payment plan which will enable nearly every farmer to put up any necessary pole line and install wiring without incurring a heavy initial expenditure. Contracts covering existing rural extensions would stand until expiration.

An increase amounting to 300 per cent in rural electrification in Georgia for the first nine months of 1929 is reported by the Georgia Power Company. At the close of 1928 the Georgia company had eleven rural lines in operation, with a total mileage of 37.51 and 382 customers. On September 30 of this year it had in operation 37 lines, with a mileage of 162.19 and 1,226 customers. By the end of the year, officials estimate, the company will be serving 75 rural communities, with a mileage of 326.78 and 2,405 customers.

Sixty-nine rural electric transmission lines, to cost approximately $1,250,000 and which will serve 1,919 customers living in 40 counties, have been authorized by the Alabama Power Company for 1930, according to recent announcement. The new lines and those authorized for the remainder of 1929 will extend for 649 miles and carry electric service into seven counties not now served. The state at the end of 1930 will have 442 strictly rural lines extending 1,446 miles and serving 9,841 customers, placing it well toward the top in this regard.

Lower Rates Sought for Farms in New York State

Governor Roosevelt's advisory farm relief commission, headed by Henry Morgenthau, Jr., conferred on November 16 at the executive chambers with representatives of power interests of New York State with the reported result that promises were made that experts will study how to effect special electric rates for the farm and rural homes. About the same time Senator John Knight, Republican leader in the Upper House, announced that the legislative commission to investigate public service commission laws and practices is to embark upon the most sweeping inquiry into the electric light and power problems of the farmer that has ever been attempted. Observers at the Capitol believe that when the Legislature meets again rivalry will be in evidence between the Governor and his Democratic supporters and the Republican legislative leaders in the matter of supplying the farms with electric light and power at the best possible rates.

At the conference just referred to Mr. Morgenthau told the power men that there are too many different plans of rural line extension in vogue and that it is desired to develop a standardized plan under which the farmer will not be called upon to pay for any part of the line construction. He also said that it was the opinion of his commission that rates charged for electric service are not sufficiently uniform and do not provide recognition of the special requirements for farm service. Most of them, he said, do not permit the use by the farmer of labor-saving appliances now available.

It was announced at the close of the session that the power companies agreed to continue their studies of methods for obtaining special rates for farm service. It was stated that the companies conceded the need of determining the charges for service to farmers on a different basis from that used for determining charges to customers in towns. Representatives of the Niagara-Hudson Power Corporation, the Associated Gas & Electric Company, the General Electric Company and other firms attended the conference. There will be another meeting within a few months.

Roosevelt Elaborates Views on Utilities

Governor of New York, Writing in "Forum," Discusses Water Power, Rates and Mergers and Calls for "Yardstick" to Measure Cost of Supplying Energy

REITERATING his often-expressed views on public ownership of water-power sites and demanding that private utility corporations be so strictly controlled that they shall not increase rates to pay dividends on what he considers watered stocks, Franklin D. Roosevelt, Governor of New York, states at length in the *Forum* for December the reasons that have led him to take the attitude he has. He declares for government operation as well as ownership of the present plant at Muscle Shoals and future ones at Boulder Dam and on the St. Lawrence River, this, in his opinion, being extremely necessary because it is the only method left of checking the actual cost of producing and transmitting electricity, upon which cost rates should be based. He is unalterably opposed to the present practice of basing rates on the theoretical cost of reproducing plants and machinery wholly new instead of on the actual cost of building them, and he thinks that the Supreme Court would also condemn this practice if it came to a test case. Extracts from the Governor's article, to which the *Forum* promises a reply from a leading power-company official, follow. On the question of public control of utilities and regulation of their rates on a fair-return basis he says:

It should be studied with deep attention by every man and woman in America, for on the answer may depend not merely the method of distributing electricity to our homes and industries, but far greater questions involving the retention or abandonment of what has been in the past the protection of the rights of individuals by the instrumentalities known as governments. If we in the United States virtually give up the control over the utilities of the nation, attacks on other liberties will follow at the hands of perfectly well-meaning people who think they are rendering a public service. We must face a theory because of a fact.

Those who are content with the present trend toward the abandonment of control over utilities ought not to be called malefactors of great wealth, or pirates or stock gamblers: they honestly believe that their theory is the right one and that they ought to be left alone. But, by the same token, those who still believe in the basic theory that a public utility is now what it has been always—a servant of the public, providing service without discrimination, at a reasonable rate and for a reasonable return on the investment—these people ought not to be howled at as bolsheviks and dangerous radicals; for, after all, they are seeking only a return to the ancient principles and the protection of the average man and woman in the reasonable enjoyment of social needs.

When the public service commissions were formed their purpose in the matter of rate making was perfectly clear, according to Governor Roosevelt:

This purpose was to grant rates to the public utility company which would net to it a reasonable return on the investment made by the bondholders and stockholders of the company, that investment representing the actual cost of the land involved and the structures on it, the cost of the machinery and reasonable amounts for depreciation and for necessary operating capital. Mark well that the investors of twenty years ago were perfectly aware that when they put their money into the bonds or stocks of public utility corporations they could not and should not expect to get the same kind of unlimited profits which they might have expected, both legally and ethically, if they had invested in wholly private enterprises which did not have the social characteristics of utilities. At the same time that they expected this limitation of profits, they also knew that the government authorities were obligated, morally at least, to authorize rates which would earn for them the interest on the bonds and a reasonable return on the stock.

During the decade from 1910 to 1920, without the knowledge or interest of the public, the process of "nibbling" at the original intent of the laws had begun. All kinds of courts scattered throughout the land began to place confusing and uncoordinated constructions on the working of the many laws. A utility company would bring in a set of account books which were so involved that the small accounting divisions of the public service commissions often just threw up their hands. Hundreds

of new items crept into both operating and capital accounts, and many wholly improper charges were thus allowed to result in increased rates to the public. There also arose such problems as how much depreciation of plant should be allowed each year and whether "obsolescence" also should be allowed, how much surplus was necessary, what kind of expenditures for advertising were proper, and so forth *ad infinitum*.

The Governor condemns pyramiding of capitalizations and an alleged practice which leads a company capitalized at $1,000,000 with $300,000 worth of stock to add a theoretical $1,000,000 to its capital value based on the "reproduction" theory and so give stockholders the right to dividends on $1,300,000, which amounts to 34 per cent on their original investment. His conclusion is:

The real milk in the electric cocoanut is the question as to which view the people of this country want to take. In the one case they will be willing to accept the obvious hope of the electric utility companies to earn an adequate return on all of the pyramiding of stocks which has gone on through the mergers and consolidations, and thereby treat public utility companies practically as if they were wholly private enterprises, accepting this with eyes open and realizing that the householders and manufacturers and farmers of the nation are the people who are paying these great profits. On the other hand, the public can insist on going back to the principles which have stood for three hundred years, differentiating sharply between a public utility and a private business, insisting that the rate of return shall be based on the prudent investment theory and on the right of the consuming public to get the lion's share resulting from improvements made in management and in modern science.

It is because Muscle Shoals and Boulder Dam and the St. Lawrence are today publicly owned that their ultimate development comes into the realm of politics. One of the most important arguments in favor of their development by federal or state authorities is that, if so developed, they will remain forever as a yardstick with which to measure the cost of producing and transmitting electricity. Such a yardstick is lacking today in the United States.

Speaking Over a Light Beam

The remarkably faithful response of the light from a neon lamp to fluctuations in current supplied to it and the equally remarkable responsiveness of the photo-electric cell to fluctuations in the light impinging upon it were, from a scientific point of view, the most impressive features of a demonstration by John Bellamy Taylor, consulting engineer of the General Electric Company, before the New York Electrical Society in a lecture on "Superspeeded Speech" given on November 6. In the demonstration the current fluctuations in the neon lamp were produced by a magnetic pick-up from a phonograph record, suitably amplified.

The beam, rendered parallel by a lens, was sent to a mirror in the back of the auditorium, and thence to the photo-electric cell placed in the focus of a concave mirror in the front of the auditorium. The minute current from the cell was in turn amplified by a number of stages to operate a loud speaker.

Another demonstration consisted in projecting the sound-track record of a moving-picture film on a screen, the light fluctuations being simultaneously received on a photo-electric cell and converted into audible speech.

League Conference in January at Westinghouse Institute

Marking the third midwinter conference of local electrical league managers, a four-day convention will be held in the Westinghouse Lighting Institute in New York City from January 13 to 16, inclusive, under the auspices of the Society for Electrical Development and the League Council. Selection of New York was in response to the majority of suggestions coming into the League Council from all over the United States and Canada, it being the opinion that because several national associations have headquarters in New York, that city was the logical place.

The business program now in preparation will cover one day devoted to a "red seal" school, one day to discussing trade association problems and two days of open forum to permit of detailed discussion of league problems.

Ford Gets a Westinghouse Collection for Dearborn

ABOVE are shown Henry Ford and F. A. Merrick, president of the Westinghouse Electric & Manufacturing Company, viewing one of the first alternating-current transformers manufactured, which makes one exhibit in a collection of nearly six hundred pioneer electrical inventions for the most part developed by Westinghouse engineers. On Tuesday of this week Mr. Ford visited the Westinghouse works at East Pittsburgh to see this early apparatus, and the collection was formally presented to him by Mr. Merrick and Vice-President W. S. Rugg for his Dearborn (Mich.) museum.

Purchases and Mergers

Alliance (Ohio) Companies Sold to Utilities Power & Light Corporation —Various Small Transactions in All Parts of the Continent

SALE of the Suburban Light & Power Company of Alliance, Ohio, controlling the Alliance Power Company, the General Light & Power Company, the Stark Electric Railroad Company and the Suburban Power Company, all of Alliance, and controlled itself by the Utilities Service Company, to the Utilities Power & Light Corporation of Chicago is announced. The sale follows a dispute between the Alliance concerns, under E. W. Sweezy, and the Ohio Power Company of Canton, from which they purchased energy.

The Southern Ohio Public Service Company of Zanesville, which furnishes electric service to about 300 central Ohio communities, has sold its equipment and interests at Buckeye Lake, as well as its power plant and site at Hebron, to the Buckeye Lake Company. The consideration was not named. The Southern Ohio Public Service Company is controlled by the American Gas & Electric Company of New York.

A petition has been filed with the Massachusetts Department of Public Utilities by the Amherst Gas Company and the Leverett Electric Company for approval of the sale to the latter of the electric plant and property of the former. The Amherst Gas Company, controlled by the Western Massachusetts Companies, serves Amherst, Hadley, Hatfield, Pelham, Sunderland and Whately with electricity.

Reports that the Fulton (N. Y.) Light, Heat & Power Company will pass into the ownership of the Niagara-Hudson Power Corporation are current in that city and there believed to be authentic.

Two small properties near Watkins Glen, N. Y.—the Schuyler Electric Light & Power Corporation and the Salt Point Electric Light & Power Corporation—have been acquired by the New York Central Electric Corporation.

A proposal has been considered by the Rochester (Minn.) City Council under which it would purchase the Olmsted County Power Company for $34,500 and add it to the city plant. Another proposal is that the city acquire for a nominal sum from the Mayo Properties Association rights in existing lines serving the Mayo medical properties.

The electric property at Pingree, N. D., has been sold by Martin Peterson to Olaf Larson.

The Alabama Power Company has announced the purchase of electric utilities from the Gulf Utilities Company at Monroeville, Beatrice, Peterman, Tunnell Springs and Uriah, Ala. The purchasing company proposes to connect these towns with its transmission system. It has also asked permission of the Public Service Commission to take over the municipal plants at Hanceville and Steppville, Ala.

Coleman (Tex.) authorities have voted not to call an election or accept the offer of $385,000 made by the West Texas Utilities Company for the municipal light and power plant.

The Canadian Utilities, Ltd., of Calgary, Alberta, and Nanaimo, British Columbia, have written the City Council of Ladysmith, B. C., offering $30,000 for the municipal power plant.

Attacking Insulation Questions

Scientific Research That Has a Definite Bearing on Solutions of Pressing Electrical Problems Is Discussed at M.I.T. Meeting in Cambridge

RESEARCH, being scientific, sometimes fails to appeal to executives and operating men because its practical significance is not always obvious. But the information presented at the annual meeting of the National Research Council committee on electrical insulation, at the Massachusetts Institute of Technology, November 14-16, has a very definite bearing on the solution of many electrical problems. Fifteen papers were presented by men coming from three electric utility companies, four manufacturers and university and laboratory circles co-operating with electrical utilities and manufacturers. The speakers delved into the fundamentals of dielectrics that must be known before problems can be solved. More than one hundred men from different parts of the country attended the meeting.

Chairman J. B. Whitehead, after pointing out that the purpose of the committee on electrical insulation is chiefly to stimulate research, follow problems, co-ordinate research and disseminate results, laid emphasis on the necessity of alliance with every one engaged in fundamental research. Because a printed report of progress had been made available he passed over this subject, but he outlined some of the absorption and breakdown characteristics of gases, liquids and solids to show their interrelation. His complete address will be presented in a later issue.

Before allowing the presentation of any papers Dr. Whitehead called attention to the fact that they represent progress reports and are not intended to be conclusive.

Stability of insulating oils was discussed by J. A. Duncan, Brooklyn Edison Company, who described laboratory equipment in which great precautions were taken to obtain accurate measures of the nature, quantity and dielectric characteristics of gases driven off from different oils at different temperatures. One commonly used oil examined emitted a gas which was more than 75 per cent hydrogen.

Cable Deterioration and Life

Studies to determine what causes cable deterioration were described by F. W. Wyatt, Detroit Edison Company. They consisted of subjecting cable insulation to (a) electronic bombardment and (b) twice-operating voltage during eight-hour heating and cooling cycles. Most of the examined oils which did not gas had poor electrical characteristics, but there were exceptions. Under bombardment power factor, moisture, acidity and conductivity increased. Hydrogen was also evolved. No conclusions have been obtained from the life tests.

Comparisons of cable life with preliminary and subsequent ionization tests were presented by D. W. Roper, Commonwealth Edison Company. These indicated that ionization tests alone do not measure cable life. Of seven cables tested, the one which had the highest power factor failed first, but others with very low power factor were not consistent in performance. Some failed early; others have not failed after twenty months of operation.

Influence of Temperature

Temperature has considerable influence on the dielectric strength of cable insulation, V. M. Montsinger, General Electric Company, declared. Several samples of untreated paper showed only 50 and 12.5 per cent of its original dielectric strength after the temperature had been raised 100 deg. and 300 deg. respectively, while treated paper showed 75 and 42 per cent respectively.

A variety of chemical studies which should be made before insulation problems can be solved were related by F. M. Clark, General Electric Company. Among other things he referred to the necessity of studying the effect of electrical fields on oil, of temperature on decomposition and of molecular configuration on performance. Not enough study has been made of artificial retarders of decomposition, he asserted.

In the discussion of this group of papers W. A. Del Mar, Habirshaw Cable & Wire Company, corroborated Mr. Roper's experience. One speaker declared that Mr. Roper's life test of cables is being specified for cables used in the English high-tension network. A. A. Wells pointed out that the source of oil and the method of treating it have considerable effect on its performance. Mr. Clark reported that an oil has been developed which has withstood 825 volts per mil at 75 deg. C. for 375 days without depreciation. He also expressed hopes that simple substitutes for oil dielectrics may be found, such as octane and dekane.

An interesting condenser type of cable joint was described by R. W. Atkinson, Standard Underground Cable Company. The potential gradient along the insulation is uniformly distributed by means of concentric cylindrical condensers joined to potential rings on the cable insulation.

The relationship between moisture content, resistivity and humidity for textile insulations was explained by A. C. Walker, Bell Telephone Laboratories. Among other things he pointed out that cellulose acetate has better characteristics than silk, cotton and wool. Attention was called to the fact that the ionic constituents of textile insulations migrate to the terminals when polarized, reducing the resistivity at these points. Washing with water has improved results considerably.

Dielectric losses, as measured by a high-frequency bridge, are not necessarily consistent with those measured by direct current, according to tests made by H. H. Race, General Electric Company. While such losses increase with temperature at lower frequencies, the opposite is true at very high frequencies.

The discrepancy between alternating-current and direct-current loss measurements may be accounted for by absorption, suggested Dr. Whitehead. W. F. Davidson, Brooklyn Edison Company, proposed waiting for stability of readings to avoid the effect of transients. Mr. Clark reported that washing of cable paper has not improved stability of performance. Mr. Del Mar suggested immersing paper in alcohol to measure moisture content, but Mr. Walker declared that cellulose retains alcohol.

Explains Results on Physical Basis

The electronic theory of the structure of matter and Du Bye's theory of dipolar ions were reviewed in very illuminating form by Dr. Hans Mueller, Massachusetts Institute of Technology, and submitted as an explanation of some peculiar characteristics of dielectrics. He pointed out that polarized ions greatly affect the dielectric constants except at very high frequencies when the ions cannot orient themselves to any appreciable extent. Polarization of ions can be out of phase with the electric field and cause dielectric loss to the extent of 30 per cent in some materials.

Discussion of Dr. Mueller's paper was participated in by Dr. Whitehead, Mr. Race and Prof. V. Karapetoff. Dr. Whitehead said he could not comprehend how 60-cycle losses can be explained by the theory presented by Dr. Mueller. The latter replied that it can be explained by the relaxation time of the polarized ions. He further contended that if the ions in molten wax are polarized and then frozen in position they can be detected as long as twelve years afterward. Mr. Race asserted that the oils with which he experimented are ordinarily considered non-polarizable so the losses must be due to something else. Professor Karapetoff declared that picture theories have been carried to an absurd degree and that the mathematical concept is the only one to rely upon.

Research conducted for the Utilities Research Commission of Chicago to ascertain some way of distinguishing between good and bad cables was reported by Prof. E. B. Paine, University of Illinois. One method employed involves a Schering bridge with the test cable in one leg. After making the closest balance possible, the infinitesimal current continuing in the diagonal circuit is amplified by radio tubes and analyzed for harmonics. By establishing artificial imperfections in cables it is hoped to be able to identify different types by the kind of harmonics produced. Another method involves the use of a radio receiver at one end of the cable for amplifying and analyzing the harmonics produced in cable with incipient faults.

Ionization studies being made for the N.E.L.A. research committee to detect any relationship with cable life were

related by Prof. C. L. Dawes, Harvard University. He explained means of separating ionization loss from ordinary dielectric loss and showed that power loss increases at a uniform rate with current and frequency but drops off at a high frequency. When the ionization curve is concave upward, it indicates longitudinal stress along the insulation, Professor Dawes contended.

COMPOUNDS AND IMPREGNATED PAPER

Studies of cable compounds, also made for the Utilities Research Commission of Chicago, were explained by Dr. W. B. Kouwenhoven, Johns Hopkins University. A modified Schering bridge is used, capable of measuring to 0.01 per cent power factor. A fairly uniform rate of compound depreciation with time was observed at temperatures between 70 and 80 deg. Alternating-current losses constitute a very good measure of deterioration, he declared, but they do not check with direct-current losses at high voltages.

Impregnated paper and oil investigations supported by the N.E.L.A., the Engineering Foundation and by manufacturers were discussed by Dr. J. B. Whitehead, Johns Hopkins University. Tests of residual air and moisture in impregnated paper are being continued which indicate a decided improvement in life with degree of evacuation during impregnation. Furthermore, the power factor is less erratic if high evacuation has been used. Surprisingly, one compound with a very high power factor had very good dielectric strength and life. A study of very short-time direct-current measurements (four-fifths of a second) indicated that peculiar humps in charge and discharge currents are due to space charges caused by previous history. Alternating-current characteristics are now being measured to ascertain their relation to short-time direct-current effects, and it appears that the two are associated. Studies of solid insulations invariably show similar charge and discharge curves. Dr. Whitehead expressed the opinion that it will be possible to substitute short-time direct-current losses in alternating-current formulas and segregate in-phase and out-of-phase losses.

Chicago to Greet Institute

District Gathering Early Next Month Will Comprise Two Student Sessions, Four Technical Sessions, Board Meeting, Banquet and Inspection Trips

TWO student sessions will form part of the district meeting of the American Institute of Electrical Engineers to be held at the Drake Hotel, Chicago, on December 2, 3 and 4. Branch chairmen will report at the first of these and ten papers, mainly of a practical type, will be presented at the second. The board of directors will meet on Tuesday afternoon, and a banquet and dance will be held on that evening. Inspection trips will include visits to the new State Line generating station, the Crawford Avenue generating station, a typical electrified steel mill, a high-capacity transmission substation, the Western Electric factory, an automatic telephone exchange and several other establishments. The engineering program is printed herewith.

Program of District Meeting, A. I. E. E.

CHICAGO, DECEMBER 2-4, 1929

MONDAY, DECEMBER 2

Morning. — Session on Student Branch Activities.

Afternoon.—Address, President H. B. Smith; address of welcome, Chicago Association of Commerce. Session on Communication: "Recent Developments in Telephone Toll Service," W. H. Harrison, American Telephone & Telegraph Company; "The Chicago Long-Distance Toll Board," E. O. Neubauer and G. A. Rutgers, Illinois Bell Telephone Company; "Manufacture of Telephone Carrier and Repeater Apparatus," R. C. Glasier, Western Electric Company; "Air Transport Communication," E. L. Jones and F. M. Ryan, Bell Telephone Laboratories.

TUESDAY, DECEMBER 3

Morning.—Session on Power Plants: "Future of Higher Steam Pressures," I. E. Moultrop, Edison Electric Illuminating Company of Boston; "Use and Design of Fault Ground Bus," R. M. Stanley and F. C. Hornibrook, Byllesby Engineering & Management Corporation; "Increased Voltages for Synchronous Machines," C. M. Laffoon, Westinghouse Electric & Manufacturing Company; "Double Windings for Turbine Alternators," P. L. Alger, E. H. Freiburghouse and D. D. Chase, General Electric Company; "A 40,000-Kw. Variable-Ratio Frequency-Converter Installation," E. S. Bundy, Niagara, Lockport & Ontario Power Company, and A. Van Niekirk and W. H. Rodgers, Westinghouse Electric & Manufacturing Company.

Afternoon.—Student Technical Session.

WEDNESDAY, DECEMBER 4

Morning.—Session on Transmission and Distribution: "Theory of a New Valve-Type Lightning Arrester," J. Slepian, R. Tanberg and C. E. Krause, Westinghouse Electric & Manufacturing Company; "Low-Voltage Alternating-Current Networks," R. M. Stanley and C. T. Sinclair, Byllesby Engineering & Management Corporation; "Economic Study of an Electrical Distributing Station," W. G. Kelley, Commonwealth Edison Company; "Experience with Carrier-Current Communication on a High-Tension Interconnected Transmission System," Philip Sporn and R. H. Wolford, American Gas & Electric Company; "Automatic Regulation for Synchronous Condensers Equipped with Superspeed Excitation," L. W. Thompson and P. J. Walton, General Electric Company.

Afternoon.—Session on Research and Development: "Polyphase Induction Motors," W. J. Branson, Robbins & Myers, Inc.; "Recording Torque Indicator," G. R. Anderson, Fairbanks, Morse & Company; "Effect of Armature Resistance on Stability of Synchronous Machines," C. A. Nickle and C. A. Pierce, General Electric Company; "Ionization Currents and the Breakdown of Insulation," J. J. Torok and F. D. Fielder, Westinghouse Electric & Manufacturing Company; "Heat Radiation in Inter-Reflection Cases," A. D. Moore, University of Michigan.

Electrochemists to Participate in Chicago Fair

Progress in electrochemistry as it will be presented at the Chicago Centennial Celebration in 1933 is now being studied by a group of scientists appointed by Dr. Colin G. Fink of Columbia University, chairman of the electrochemistry exhibit. Those who will assist Dr. Fink include Prof. C. J. Brockman of the University of Georgia, T. F. Bailey of the Bailey Electro-Furnace Company, Alliance, Ohio; Prof. H. S. Lukens of the University of Pennsylvania, and L. D. Vorce of the Westvaco Chemical Company, South Charleston, W. Va.

The group will act under the supervision of the National Research Council's science advisory committee, of which Dr. Fink is a member. This committee, consisting of forty or more leading American scientists in both the pure and applied fields, has been asked by the Century of Progress trustees of the fair to work out a basic science theme to be the dominant feature of the Chicago centennial.

International Commission Considers Kootenay Dam

Members of the International Joint Commission recently held a hearing at Bonners Ferry, Idaho, where more than a hundred farmers of north Idaho registered their protest against the projected damming of the Kootenay River at Granite, Idaho, by the West Kootenay Power & Light Company of British Columbia, on the ground that the dam would result in inundation of valuable diked and reclaimed lands in northern Idaho.

After hearing testimony from Robert Crowe, counsel for the West Kootenay Power & Light Company, and from interested individuals, the commission denied permission for immediate development and ordered engineers to investigate the possibility of damage to American lands by the British Columbia company's power project. Authorization was given for the excavation for the dam as it was declared that preliminary work will not affect the lake level. A future hearing will be scheduled for the decision, and the American farmers are expected to complete their data before that time.

Members of the International Joint Commission are former United States Senator Fred Dubois of Idaho, former Senator P. J. McCumber of North Dakota and John H. Bartlett, former Governor of New Hampshire and chairman of the American Section; George W. Kyte, former member of the Dominion Parliament from Richmond, Nova Scotia; Sir William Hearst, former Premier of Ontario, and C. A. Magrath, former member of the Dominion Parliament from Medicine Hat, Alberta, present Ontario Hydro chairman and chairman of the Canadian Section.

Briefer News

TENNESSEE PUBLIC SERVICE INFORMATION BUREAU CLOSED.—Directors of the Tennessee Public Service Information Bureau, organized ten years ago by 27 companies, have decided to discontinue its activities, it being thought that the money contributed by utility companies for its upkeep can be better expended in furtherance of the same ends by each in its respective area.

GENERATING CAPACITY AT DIX DAM INCREASED.—To augment the generating capacity of the Kentucky Utilities Company's hydro-electric plant on the Dix River, near Burgin, Ky., installation of a series of gates and bulkheads across the spillway of the dam has just been completed which will increase the head by 10 ft. The present head is more than 200 ft., and the power house contains three 12,000-hp. turbo-generators.

DISTRICT CONFERENCE OF OKLAHOMA UTILITIES ASSOCIATION. — A Western District conference of the Oklahoma Utilities Association was held at Elk City on November 21, under the chairmanship of John T. Naylon. A motion picture of incidents in Edison's life and addresses by Secretary E. F. McKay, H. H. Hatchett, A. E. Warner, G. B. Dunlap, Campbell Russell, S. I. McElhoes, Tom Gilmer and J. T. Beall were the scheduled events.

NEW RATES ON JANUARY 1 FOR MOUNTAIN STATES POWER COMPANY.—Upon its own volition the Mountain States Power Company of Albany, Ore., has reduced rates affecting commercial and residential lighting service. A saving to customers of approximately $30,000 annually is involved. In the territory are Marshfield, North Bend, Coquille, Myrtle Point, Powers, Empire and Eastside. The revised schedule will become effective January 1.

STEEL-TOWER LINE FROM PORTSMOUTH TO SOUTH POINT, OHIO, UNDER WAY.—Work on a steel-tower transmission line from Portsmouth to South Point, Ohio, which is being erected for the American Gas & Electric Company, is progressing rapidly despite the fact that it runs through country where because of rugged topography and lack of roads transportation of men and material provided a problem. The right-of-way, 100 ft. wide and 36 miles long, had to be cleared through heavy timber for 90 per cent of its length.

ELECTRIC SECTION OF EMPIRE STATE ASSOCIATION TO MEET NEXT MONTH.—At the annual meeting of the Electric Section of the Empire State Gas and Electric Association to be held at Briarcliff Manor, N. Y., on December 5 and 6, there will be three business sections. Subjects include lead-sheath composition and splicing methods, underground construction in suburban communities, series capacitors for voltage regulation, rural-line development, frequency control, economic value of lightning arresters, radio interference and fault finding, new developments in electrical apparatus, and the relation of undervoltage to service and revenue. Colonel J. P. Hogan will speak at the banquet on Thursday evening, his subject being railroad electrification.

NATIONAL ADVERTISING DESIGN FOR ELECTRIC HEAT.—Herewith is shown the design chosen by the National Electric Light Association and the Electric Furnace Section of the National Electrical Manufacturers' Association for use in national advertising to promote

electric heat in industry. The slogan "Investigate electric heat" won first prize in the recent N.E.M.A.-N.E.L.A. slogan contest. It is expected that central-station companies and manufacturers of electric furnaces and allied products will use this design in advertising directed to the numerous industries employing electric heat.

MUNICIPAL-PLANT-MINDED TOWN LOOKS TO PRIVATE COMPANY FOR LIGHTING. — Although it voted overwhelmingly for a municipal power plant last August, the town of Hicksville, Ohio, has reopened negotiations with the Ohio Power Company for a new boulevard lighting system for the business section. The power company has offered to install the lighting system gratis provided it obtains a ten-year contract for lighting or to furnish energy at the present rate without a contract as to time.

NEW YORK & ONTARIO POWER COMPANY AGAIN SEEKS ST. LAWRENCE RIVER SITE AT WADDINGTON. — It is announced from Ogdensburg that the New York & Ontario Power Company has again applied to the International Joint Commission for a permit to use the power of the St. Lawrence River at Waddington, N. Y. If one is granted, a power house costing $500,000 will be built and from 20,000 hp. to 30,000 hp. distributed in that section of the state. Power rights at the site in question were acquired in 1905 by the New York & Ontario Power Company, and an action by New York State to test title has been withdrawn.

ST. JOHN, N. B., ABOUT TO HAVE ITS POWER SUPPLY DOUBLED.—A new 7,500-kva. steam-electric unit is receiving tests in the plant of the New Brunswick Power Company at St. John, N. B. In the new plant, which more than doubles the supply of power for St. John, the turbine and Canadian Vickers boiler, with their auxiliaries, occupy the space originally housing six old hand-fired boilers. Utilizing pulverized coal, the boiler is designed to operate at 440 lb. steam pressure with 250 deg. of superheat.

MARYLAND COMPANIES OBSERVE TERRITORIAL AGREEMENT. — Permission for the Potomac Edison Power Company to construct transmission lines in seven communities of Montgomery County and adjacent territory has been given by the Maryland Public Service Commission. Before the application was filed a petition that the Consolidated Gas, Electric Light & Power Company extend lines into the territory was made by residents. The Consolidated, however, refused, holding that the section rightfully belonged to the Potomac Edison under an agreement.

KANSAS CITY POWER & LIGHT COMPANY TO BUILD NEW OFFICES.—Construction work on a sixteen-story office building for the Kansas City Power & Light Company on property recently acquired on Baltimore Avenue between Thirteenth and Fourteenth Streets is to start soon. Tentative plans call for foundations of sufficient depth to carry additional stories as they are needed. A garage is to be constructed in the rear. Probably half of the new structure will be occupied by offices and showrooms of the company.

RAIN AND FLOODS HAMPER SALUDA RIVER PLANT CONSTRUCTION.—Unprecedentedly heavy rains and consequent floods have hampered construction work on the Saluda River hydro-electric development in South Carolina, but in spite of the delay resident engineers expect to complete the plant on schedule so that it will be in full operation by September, 1930. One generator may be in operation by July. The floodwaters which came down the river, carrying out a number of bridges on their way, washed out some of the filling from the dam and, pouring through the diversion tunnel, damaged the power-house structure.

NEW UNIT GOES INTO SERVICE AT EL PASO.—C. W. Kellogg, president of the Engineers' Public Service Company, announces that the first unit of 25,000 kw. rating in the new Rio Grande generating station of the company's subsidiary at El Paso, Tex., has been put into service. This plant, begun early this year, was rushed to completion to take care of the

greatly increased demand for power made on the El Paso Electric Company, notably by the new electrolytic copper refinery of the Nichols Copper Company. The new power plant burns natural gas piped from southwestern New Mexico fields and obtains an adequate supply of condensing water from the Rio Grande irrigation system.

NEW WALLOWA RIVER PLANT DEDICATED.—A 1,250-kva. hydro-electric plant on the Wallowa River at Joseph, Ore., was dedicated by the Pacific Power & Light Company on November 2. The plant contains a 1,450-hp. Pelton waterwheel, horizontal type, to operate at a head of about 160 ft. Arrangements were made with seven irrigation companies for the use of a dam jointly owned by those companies at the outlet of Wallowa Lake for the intake to the 6,600-ft. wooden-stave pipe line. The development was completed in three months at a cost of approximately $150,000. The plant is to be used primarily as a standby for the Enterprise-Joseph district.

LOS ANGELES POWER AND LIGHT BUREAU LOWERS RATES. — The City Council of Los Angeles has approved a new rate schedule for customers of the Los Angeles Bureau of Power and Light which is to go into effect January 1. Under its provisions the domestic consumer will pay 4.8 cents per kilowatt-hour for the first 25 kw.-hr. consumed in any one month for dwellings having five or less lighting circuits and for 5 kw.-hr. per lighting circuit for each circuit in excess of five. For the next 140 kw.-hr. consumed in any one month 2.5 cents per kilowatt-hour will be charged, and for all in excess thereof consumed in any one month 2 cents. A minimum monthly charge of 60 cents will be made except for air heating. Commercial lighting and industrial power rates are also reduced. The new rate schedule is said to be approximately 12½ per cent lower than the one under which the department is now operating.

COMMERCIAL RATES OF GEORGIA POWER COMPANY READJUSTED.—Revenues of the Georgia Power Company will, it is estimated, be reduced $200,000 a year on the basis of present consumption by an order just issued by the Georgia Public Service Commission revising the rates covering combined commercial lighting, power, cooking, heating and refrigeration in the cities served by that corporation. A feature of the new schedule is the introduction of a demand charge of $1.11 a month for meters of not over 10 amp. and $2.22 a month for meters of 220-volt capacity and equivalent. This service charge is in addition to an energy charge of $6.66 for the first 200 kw.-hr. a month, $5.55 for the next 1,800 kw.-hr. a month and $4.44 for all over 2,000 kw.-hr. Two other commercial schedules are included. The new rates will bring approximate uniformity in more than 200 Georgia cities.

Coming Meetings

[A complete directory of electrical associations, with their secretaries, is published in the first issue of every volume. For latest list see issue of July 6, page 46.]

American Institute of Electrical Engineers—District meeting, Chicago, Dec. 2-4; winter meeting, New York, January 27-31. F. L. Hutchinson, 33 West 39th St., New York.

American Institute of Mechanical Engineers—New York, Dec. 2-6. C. W. Rice, 29 West 39th St., New York.

American Society of Refrigerating Engineers—New York, Dec. 4-7. D. L. Fiske, 37 West 39th St., New York.

Empire State Gas and Electric Association—Electric Section, Briarcliff Manor, N. Y., Dec. 5-6. C. H. B. Chapin, Grand Central Terminal, New York.

National Electrical Credit Association—New York Division, Hotel Pennsylvania, New York City, Dec. 10; New England Division, University Club, Boston, Jan. 21. F. P. Vose, 1008 Marquette Bldg., Chicago.

American Engineering Council—Washington, Jan. 9-11. L. W. Wallace, 26 Jackson Place, Washington, D. C.

North Central Division, N.E.L.A.—Commercial Section, St. Paul Hotel, St. Paul, Jan. 20-21; Engineering Section, Nicollet Hotel, Minneapolis, Feb. 24-25. J. W. Lapham, 803 Plymouth Bldg., Minneapolis.

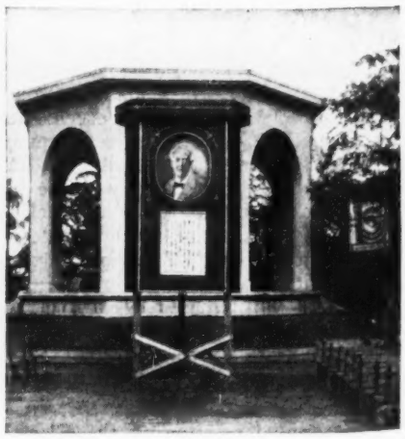
National Electrical Wholesalers' Association—Pacific Division, Del Monte, Calif., Jan. 31-Feb. 1.

HYDRO-ELECTRIC PERMIT FOR GRAND RIVER, OKLA., IS AGAIN TRANSFERRED.—The third transfer of a permit to construct hydro-electric dams and a power plant on the Grand River in Oklahoma is announced by the State Commission of Drainage and Irrigation. The commission has approved the transfer of the permit, which has been held for several months by Wash Hudson, Tulsa, and associates, to the Grand Hydro Corporation. The permit calls for a plant capable of developing 400,000 hp. Plans provide for a master dam 150 ft. high in Mayes County, a second dam east of Pryor, a third at the mouth of Clear Creek and a fourth east of Wagoner. The preliminary survey of the project has been completed and engineers are now drafting final plans for the project, according to Mr. Hudson, who asserts that the organizers of the new corporation are men of wealth able to carry the project through to completion. The first permit was issued in 1926 to James F. Robinson of Miami, Okla.

BALTIMORE GAS & ELECTRIC TO USE SUBMARINE CABLE LAID FROM FORT MCHENRY TO LAZARETTO LIGHTHOUSE.—A 33,000-volt electrical cable line will be laid in a channel 20 ft. below the bottom of Baltimore Harbor from Fort McHenry to the Lazaretto Lighthouse. It will be part of a line 4 miles long through which the Consolidated Gas, Electric Light & Power Company will supply energy from its Gould Street station, Port Covington, to the plant of the Western Electric Company at Point Breeze. The Consolidated Gas & Electric will dredge the channel and lay the cable, other portions of the line being built by the Electrical-Mechanical Bureau of the city of Baltimore, which will carry the line to Point Breeze.

ELECTRIC WELDING AND HEATING DISCUSSED BY A. I. AND S. E. E.—Arc welding and electric heating were discussed on November 13 and 14 during a two-day conference in Pittsburgh sponsored by the Pennsylvania State College and the Association of Iron and Steel Electrical Engineers. E. Tyler Davis, vice-president of the Tyler Tube & Pipe Company, Washington, Pa., was in the chair, and the speakers included K. L. Hansen, consulting engineer, Milwaukee, Wis.; Wirt S. Scott, Westinghouse Electric & Manufacturing Company, Mansfield, Ohio; R. M. Hussey, Jones & Laughlin Steel Corporation, Woodlawn, Pa.; Harry Restofski, Pittsburgh; F. W. Cramer, Youngstown, Ohio; J. F. Lincoln, Lincoln Electric Company, Cleveland, and James Kniveton, Philadelphia.

"Light's Golden Jubilee" in the Orient



THREE thousand students of electrical engineering in Tokyo, Japan, took part in the celebration of "Light's Golden Jubilee" by marching to the Imperial Palace with Japanese lanterns and cheering vociferously. The headquarters of the celebration are shown on the left. On the right is a Japanese artist's portrait of Edison with an inscription in Oriental characters.

State Supreme Court Sustains Utility Fighting Submeters

The right of a public utility to refuse to furnish electrical energy to the owner of an apartment house through a master meter for resale to tenants, for the profit of the apartment owner and the meter company, was sustained by a decision of the Supreme Court of New Jersey November 15, in a case where it had been sought to compel the Public Service Electric & Gas Company to supply such service.

"If the utility should be compelled to submit to this practice," the court says, "it is conceivable that the meter company, or some like concern, could become a very real competitor. The meter company could take each square block as a unit of operation and, by keeping its paraphernalia off the public streets, refrain from becoming a utility, keep out of the control of the Board of Public Utility Commissioners, take its power through a master meter somewhere in the square, and compete with the utility for sale and delivery to the various users within the block."

A syllabus of the court's opinion, written by Justice Case, follows:

Electric current, in the aspect of sale and purchase, is property.

It is possible for lawful restrictions to be imposed on the sale thereof.

The refusal by a public utility to sell electric current to an apartment house owner for the purpose of being remetered and resold to tenants is not violative of such owner's constitutional property rights.

The Board of Public Utility Commissioners has general supervision and regulation of, jurisdiction and control over electric current, so long as it is in the ownership of the utility, and such board has power to fix reasonable classifications, practices and service to be furnished with respect thereto.

It being the uniform practice and policy of the utility to refuse to sell electric current at wholesale to a retailer for redistribution and resale by the latter to the consumer at retail rates, the application of the practice in a given case is not discriminatory, and the action of the Board of Public Utility Commissioners in refusing to compel the utility to make such sale is not an unreasonable or otherwise unlawful exercise of power.

Recent Court Decisions

TAXING POWERS OF COLORADO BOARD OF EQUALIZATION.—In Colorado it has been the practice for the Tax Commission to fix the valuation and tax assessment of utilities, complaints being settled by the Equalization Commission. In a case taken to the courts in which the Public Service Company of Colorado was concerned protest was made that the valuations for 1927 were raised without notice. The United States Court of Appeals, sitting at Wichita, Kan., has sustained the plaintiffs, holding that the state board of equalization cannot raise or lower the valuation of any individual taxpayer, but can only raise or lower the valuation of classes or sub-classes of property. While the board may, for instance, order the valuation of all railroads raised or lowered by a certain per centage, it cannot single out any one road or group of roads and order a change in their valuation. The court observed: "Assessment is personal, while equalization is impersonal."

FUTURE REVENUE CAN BE PLEDGED AS SECURITY FOR MUNICIPAL PLANT BONDS.—Two Circuit Court decisions in South Dakota have upheld the right of the city of Watertown to issue $150,000 of revenue bonds for building an addition to the municipal electric light and power plant. One of these rulings was that the city has a right to sell bonds with the future revenue of the plant as security for principal and interest. In the other an injunction to prevent construction of the addition and stop the sale of bonds was refused by the court.

FORMER ACQUIESCENCE IN UNAUTHORIZED OCCUPANCY OF STREETS DID NOT ESTOP CITY FROM OUSTER PROCEEDINGS.—State of Ohio *ex rel.* Martin vs. Ohio Electric Power Company was a suit to oust the defendant's poles and wires from the streets of Norwalk, Ohio. Questions of succession in ownership were decided by the trial court against the perpetual right claimed by the defendant to occupy the streets. This decision has been sustained by the Supreme Court of Ohio, which said that mere acquiescence in the continued unauthorized occupancy of streets, or nonaction on the part of public officials to prevent obstruction, or delay in bringing action to procure an order of ouster, could not confer any right upon a company operating an electric light system to continue to occupy streets for poles and wires, or estop a city from maintaining quo warranto proceedings to oust company. (167 N.E. 877.)*

HOLDING COMPANY DOES NOT OWN ASSETS OF SUBSIDIARY.—The New York Supreme Court, Appellate Division, in New York State Electric Corporation vs. Public Service Commission, overruled a commission finding which denied the plaintiff's application for leave to sell a specified quantity of its common stock to the New York Electric Company. The court said that the commission's refusal of permission to sell such stock to a foreign holding corporation which, with the domestic corporation, was a subsidiary of another domestic corporation—the Associated Gas & Electric Company—on the ground that the regulating body desired to prevent a foreign corporation from acquiring control of a state utility was unreasonable, since the operating company was subject to the commission's regulatory powers. The court held that ownership by a corporation of substantially all the stock of a subsidiary company does not give the former an interest in the specific assets of its subsidiary, but such assets belong to the corporate entity, which is required to operate the property and which is responsible to the Public Service Commission. (236 N.Y.S. 411.)

FEDERAL AND STATE JURISDICTION OVER CONOWINGO ENTERPRISE.—An injunction was sought against the Philadelphia Electric Company by Levin et al. to restrain it from constructing a transmission line in connection with the Conowingo hydro-electric plant until the plaintiffs had been compensated for alleged damage to their lands. The United States District Court for the Eastern District of Pennsylvania disclaimed jurisdiction, ascribed to it under the federal water-power act, which gives concurrent jurisdiction to the courts of the United States and of the state to enforce all rights therein granted. The court held that "the act of Congress has to do only with damages growing out of the construction and operation of the dam, and nothing to do with damages caused by the construction or operation of the distribution line. The complaint has to do only with the latter. There is in consequence no applicable law of the United States, and the courts of the state are alone concerned with the state law. We are not in accord with the proposition that jurisdiction can be given the courts of the United States to administer the state laws by the simple expedient of linking to a cause of action given by the state law an unfounded claim to a cause of action under a law of the United States." (34 Fed. [2d] 224.)

*The left-hand numbers refer to the volume and the right-hand numbers to the page of the National Reporter System.

Commission Rulings

TEN PER CENT ADDITION TO ACTUAL COST OF BETTERMENTS APPROVED.—The Nebraska State Railway Commission has approved the request of the Northwestern Public Service Company of Huron, S. D., which operates several important plants in Nebraska, to be allowed to add 10 per cent to the actual cost of additions and betterments made during the last fifteen months, holding this to be a reasonable allowance where a company supplies the labor and material and superintends the construction of the additions.

COLORADO COMMISSION MAKES RULES FOR EXTENSIONS.—The Colorado Public Utilities Commission has issued an order requiring every company in the state to file with it within thirty days a full statement of its extension policy. No consumer, the commission decreed, shall be required to advance money for extension of service except in accordance with such policy. Advance payments from consumers shall not exceed the cost of the extension specifically contemplated. If an estimate cost is necessary for collection in advance, the amount shall be adjusted promptly after construction is completed. The amount to be paid by the consumers shall not be applied to transformers, lightning arresters or other recoverable property or protective equipment except as to labor and hauling cost of installation. Allowance of amounts equal to what the utility would expend for obtaining new business shall be made to the consumers. The extension is to become the property of the utility on completion and is to be maintained, controlled and operated by it. Similar provisions shall be made for privately owned lines connecting with a utility line, to the point of connection. When it is not feasible to meter the energy used by a consumer on a privately owned line at this connecting point because of the cost of primary metering, the secondary metering records shall be adjusted to take reasonable account of the line and other losses between the meter and that point. The utility may construct additional extensions at any time it desires to do so at its own expense.

News About Men of the Industry

J. G. Holtzclaw Heads Virginia Utility

Jack G. Holtzclaw, who has been elected president of the Virginia Electric & Power Company, as announced in the November 16 issue of the ELECTRICAL WORLD, has been connected with the Stone & Webster interests for more than twenty years and at the time of his election to the presidency of the Richmond utility he was occupying the same position with the Gulf States Utilities Company with headquarters in Beaumont, Tex. During this period of service he has been identified with operating companies in various sections of the country and this experience has given him an extensive knowledge of industrial conditions and utility problems.

Mr. Holtzclaw is a native of Georgia and a graduate of the electrical engineering department of the Georgia School of Technology. He was affiliated with the Savannah (Ga.) Electric & Power Company at first, but later he removed to Pensacola to become chief executive of the electric light and power and traction properties in that city. It was in 1925 that he became identified with the Beaumont properties. Mr. Holtzclaw is active in association work, being a past-president of the Southwestern Division of the National Electric Light Association.

PRESIDENT HOOVER has been asked to serve as honorary chairman of the American committee of the World Power Conference. The invitation was extended by H. J. Pierce, vice-chairman of the committee.

SHIZUO KATOH, president of Denki-Gakko (Institute of Electrical and Mechanical Technology), Tokyo, and editor of *Ohm*, a magazine devoted to electrical engieering published in Japan, returned to his native country last month after an extended visit in this country, during which he investigated American methods of public utility operation and American engineering educational systems.

ROSCOE C. MCCULLOCH, chairman of the Ohio Public Utilities Commission, has been appointed United States Senator to fill the vacancy caused by the death of the late Senator Theodore E. Burton of Cleveland. The new Senator will serve, under the appointment of the Governor, until December 15, 1930. In order to complete the senatorial term, which expires March 4, 1933, the appointee will have to run for election next year. Mr. McCulloch is a native of Ohio and received his education at Ohio State University and Western Reserve University Law School. He was admitted to the bar in 1903.

U.G.I. Elects New Vice-Presidents

Stuart Cooper and Fred B. Hofft were elected vice-presidents of the United Gas Improvement Company at a meeting of the company's executive committee held November 15, according to an announcement by John E. Zimmermann, president. Both Mr. Cooper and Mr. Hofft have had many years' experience in public utility operation and management. Mr. Cooper, who was born in Clayville, N. Y., in 1887, began his business career with the Syracuse (N. Y.) Lighting Company, a U.G.I. subsidiary, in 1905, as a meter tester, where he advanced to assistant superintendent. In 1910 he entered Syracuse University, from which he received the degree of electrical engineer in 1914. Subsequently he was assistant to the electrical engineer of U.G.I. and held important positions with the Counties Gas & Electric Company, Norristown, Pa., and the Charleston (S. C.) Consolidated Railway & Lighting Company, both U.G.I. subsidiaries, of which latter company he was vice-president and general manager, and president of the South Carolina Power Company, the successor of the Consolidated company. In July, 1928, he became vice-president of the Philadelphia Suburban-Counties Gas & Electric Company, which recently was merged with the Philadelphia Electric Company.

Mr. Hofft was born in Indianapolis in 1878 and was graduated in electrical engineering from Purdue University in 1902, when he entered the employment of the Indianapolis Street Railway Company on power house and substation operation. In 1903 he became associated with the Merchants Heat & Light Company, Indianapolis, of which he later became general superintendent, and in 1909 he was made general manager of the Monmouth (Ill.) Public Service Company, a consolidation of electric light, gas, steam heating and ice manufacturing plants. In 1912 he was made general manager of the Olean (N. Y.) Electric Light & Power Company and vice-president of the Erie (Pa.) Lighting Company, the latter company then being under the management of Day & Zimmermann of Philadelphia. When the Erie Lighting Company became a part of the Penn Public Service Corporation, in 1923, Mr. Hofft was elected vice-president in charge of operations for the northwest region of that company, and in 1927 was placed in charge of the entire Penn Public system, now the Pennsylvania Electric Company with headquarters at Johnstown, Pa.

G. R. Jones Named President of Western United Companies

George R. Jones, vice-president and treasurer of the Public Service Company of Northern Illinois, has resigned his position as assistant to the president and assistant treasurer of the Western United Gas & Electric Company and the Western United Corporation to become president of both companies. Samuel Insull, who heretofore has been president of these companies, has resigned that office to become chairman.

Mr. Jones became connected with the Western United companies in December, 1927, at the time the management of these companies was taken over by Mr. Insull and associates. In 1911, at the time of the organization of the Public Service Company of Northern Illinois, Mr. Jones was appointed purchasing agent in charge of purchasing and stores. Prior to that he was purchasing agent for the North Shore Electric Company. In 1919 Mr. Jones was made assistant to Vice-President Gulick, and shortly thereafter he was elected secretary and treasurer of the Public Service Company. His election as vice-president took place in August, 1926.

JOHN W. BRICKER has been appointed a member of the Ohio Public Utilities Commission by Governor Cooper to fill the vacancy caused by the resignation of Roscoe C. McCulloch, who was recently appointed United States Senator to succeed the late Theodore E. Burton. Mr. Bricker is appointed to complete Mr. McCulloch's term, which expires February 1, 1933. From 1923 to 1927 Mr. Bricker was assistant attorney-general, assigned to the utilities commission. During that time he represented the state in approximately 200 cases appealed by utilities corporations from the commission to the courts. Since leaving office as assistant attorney-general he has been a member of the law firm of Postlewaite & Bricker of Columbus. Judge Frank W. Geiger, a member of the commission, has been appointed chairman to succeed Mr. McCulloch.

Obituary

T. P. Walker in Beaumont

Thomas P. Walker, operating vice-president of the Virginia Electric & Power Company, with headquarters in Richmond, has been named president of the Gulf States Utilities Company to succeed J. G. Holtzclaw, who has assumed new duties in Virginia. Mr. Walker has been connected with Stone & Webster since graduation from the University of Nevada. His first connection was at Reno and after a short time he was transferred to the Boston office. After discharge from military service he assumed the duties of superintendent of the properties at Haverhill, Mass., and later was advanced to the position of manager of that property. From Haverhill he went to Baton Rouge and from Baton Rouge to El Paso, in all these connections holding executive positions. In the spring of 1927 Mr. Walker was elected vice-president of the Virginia Electric & Power Company, Norfolk division, and the following year he was named operating vice-president with offices at the company headquarters in Richmond.

A. H. Heitzler Heads Electric Department in Denver

A. H. Heitzler, for the past five years division manager at Lorain for the Ohio Public Service Company, has been appointed superintendent of the electric department of the Public Service Company of Colorado with headquarters in Denver. Mr. Heitzler has had a varied career with the Ohio Public Service Company, having served in widely scattered properties. He received his technical education at the University of Texas, from which institution he was graduated as an electrical engineer, and after a few months' training at the Doherty Training School in Denver he was transferred to the Toledo Railway & Light Company as designing engineer and later served in the same capacity for the Acme Power Company. In 1917 he was transferred to what was then the Mansfield Electric Company as chief engineer. After occupying that position for six months he was again transferred as assistant to the general manager of the City Light & Water Company at Amarillo. Following military service Mr. Heitzler was connected with the New York office for a while, but in 1920 he was appointed general superintendent of the Alliance Gas & Power Company, serving later at Massillon, Elyria and Lorain.

Robert M. Searle

Robert M. Searle, president of the Rochester Gas & Electric Corporation, whose death was announced in the November 16 issue of the ELECTRICAL WORLD, was widely consulted in the electrical industry as an expert in utility matters, both engineering and financial. He had been connected with the Rochester properties since 1906, when he was appointed general manager of the Rochester Railway & Light Company, predecessor of the Rochester Gas & Electric Corporation, then controlled by the Andrews-Vanderbilt syndicate. From this position he steadily advanced through the office of vice-president to that of president, retaining the position of chief executive when the company became the nucleus of the E. L. Phillips interests in western New York and when the Associated Gas & Electric Corporation took over the Rochester utility.

Mr. Searle was born in Peekskill, N. Y., in 1869 and, being thrown upon his own resources, he began his business career as an office boy with Thomas A. Edison. Subsequently he entered the employ of the United Gas Improvement Company of Philadelphia in a subordinate position, but after years of untiring zeal he was named a vice-president of a subsidiary company. Later he became an operating executive of the Consolidated Gas Company of New York. The marked ability of Mr. Searle was in the meantime recognized by many of the utility executives with whom he came in contact and in 1906 the Andrews-Vanderbilt syndicate appointed him general manager of the Rochester company. Mr. Searle was a member of the American Institute of Electrical Engineers, Illuminating Engineering Society, Empire State Gas and Electric Association and other similar organizations. On many occasions he proved to be public spirited, giving generously of his time and energy in worthy causes. In 1922 he served as a member of the committee to work with the New York State Public Service Commission to aid public utilities to obtain fuel during the coal strike. He also served as fuel administrator of the western district of New York, covering eight counties.

JOHN PETTIT RIGSBY, general engineer at the South Philadelphia plant of the Westinghouse Electric & Manufacturing Company, died suddenly at his home, Ridley Park, Pa., recently, as the result of pneumonia. Mr. Rigsby, who was 51 years of age, was born in Stoneybrook, Ont., and was graduated in mechanical engineering from the University of Toronto in 1899. In 1903 he joined the Westinghouse company and worked his way up through the ranks from a position in the designing room to become general engineer.

SIGNOR EMILIO PIAZZOLI, well-known Italian electrical engineer, died in Catania, Sicily, at the age of 70. The deceased was for some years chief engineer of the municipal electricity supply undertaking in Milan and later consulting engineer of the Società Generale Elettrica della Sicilia.

THERON I. CRANE, early associate of Thomas A. Edison and founder of the Pilling & Crane Iron & Steel Company, Philadelphia, died November 2 at the age of 69 in the Bellevue-Stratford Hotel. Mr. Crane was a director of the Edison Storage Battery Company, Edison Portland Cement Company, Bank of North America and Trust Company and of other industrial enterprises.

WALTER MELLON, superintendent of the automatic substations of the Union Electric Light & Power Company of St. Louis, Mo., died November 13 at his home in that city from an illness contracted several months ago. Mr. Mellon, who was 40 years old, was a Fellow of the American Institute of Electrical Engineers and formerly chairman of that organization's automatic substation committee. He had been with the Union Electric for 26 years.

B. J. BROWN, superintendent of the meter department of the Duke Power Company, Charlotte, N. C., died October 2. Mr. Brown was a native of Charlotte and a graduate of the North Carolina State College of Agriculture and Engineering. At first he spent some time with the Westinghouse Electric & Manufacturing Company in the testing department and then became a meter expert in the company's Chicago district. This position he was compelled to leave because of ill health, and it was in 1906 that he resumed work in the meter testing department of the Southern Power Company.

JAMES T. WATSON of the Westinghouse Electric & Manufacturing Company and with residence at Wilkes-Barre, Pa., died September 17. Early in his career Mr. Watson served as electrician for the Waynesboro Electric Light & Power Company, as foreman of interior wiring for Charles B. Scott, electrical contractor at Scranton, Pa., and as chief foreman of electricians for the Delaware & Hudson Company of Scranton. More recently he had been superintendent of the Blue Ridge Light & Power Company, Staunton, Va., and electrical engineer of the Tennessee Copper Company, Copperhill, Tenn. Mr. Watson was a member of the A.I.E.E.

Financial and Statistical News

WHILE the expression "back to normal" is quite inadequate to describe the current market situation, a degree of stability lacking for weeks has returned, along with a tempered optimism. The majority of brokers are advising purchases, but earnings are more carefully scrutinized.

——HAVING SUFFERED HEAVIER LIQUIDATION than any other large class of stocks, utility issues have responded promptly to buying impetus. A representative group has recovered 13 per cent (November 20), on the average, of its loss from the top. The average yield on these issues is still well over 3 per cent.

——NEW FINANCING has been virtually at a standstill during the past month.

Price of Electric Current Is Still Downward

The downward trend in the average price of domestic electric service continues, according to statistics for the electric light and power industry issued for September by the National Electric Light Association.

Taking the United States as a whole, the average for the twelve months ending with September 30 was 6.30 cents per kilowatt-hour. This compares with an average of 6.40 cents for the period ended June 30, with 6.50 cents for the period ended March 31 and with 6.55 cents for the calendar year 1928.

According to the present trends, the final average for the whole year of 1929 will be in the neighborhood of 6.2 cents per kilowatt-hour, a decrease of more than 5 per cent during the year.

Coincidently with this progressive decline in the average rates the amount of electricity used by the average customer has shown a steady increase. During the twelve months ended September 30 the average for the United States as a whole was 487 kw.-hr., as compared with 459 for the calendar year 1928. For the entire year of 1929 present trends indicate an annual use of 500 kw.-hr., an increase of 41 units per consumer, or of nearly 9 per cent over the previous year.

Recent Listings

The New York Stock Exchange has authorized the listing on or after December 23 of 211,772 additional shares (par $100) capital stock of the Detroit Edison Company on official notice of issuance and sale and payment in full, making a total of 1,272,260 shares applied for. The exchange has also authorized the listing of 75,000 shares of common stock (no par) of the Commonwealth Power Corporation on official notice of issuance and payment in full in connection with the acquisition of the Tennessee Electric Power Company, making the total amount of common stock applied for 1,720,054 shares. There have been authorized the listing of 36,997 additional shares of common stock of the Pacific Gas & Electric Company (par $25) on official notice of issuance and payment in full, making the total amount of common stock applied for 3,798,717 shares. On the big board there have also been authorized for listing 19,400 additional shares of capital stock (par $25) of Yale & Towne Manufacturing Company upon official notice of issuance and payment in full, making the total applied for 486,656 shares.

British Columbia Power Shows Rapid Growth

Serving a rapidly developing residential and industrial area along the North Pacific Coast, the British Columbia Power Corporation has hit a stride of growth comparable to that of the leading United States power systems. Power sold has increased from 197,827,727 kw.-hr. in 1925 to 342,627,810 this year and the number of electric power and light consumers has increased in the same period from 84,587 to 105,908.

The amount expended during the year in providing additional plant, equipment and improvements to meet the public demand and growth in the territory served was $4,612,251. The principal construction expenditures were in providing additional power, light and gas plant and distributing systems and the extension of these services into new areas.

The consolidated balance sheet as of June 30 last shows assets of $131,371,911. Gross revenue for the year ended June 30 was $14,681,263.

How Much Are Stock Dividends Worth?

Holder Should Know Whether He Has Just Additional Pieces of Paper or Whether Earnings Have Been Capitalized

By WADDILL CATCHINGS
Vice-President Goldman, Sachs & Company

CURRENT, periodic stock dividends* certainly should not be declared by a corporation unless the earnings fully justify such dividends. As long as the investing public regards such dividends as adding to the value of common-stock holdings no such dividends should be declared unless there is a real basis for believing that there is this increase in value. It is obvious that there is great opportunity for misleading the investor if these dividends are declared without justification. Investment bankers must be alert to discover the facts behind the declaration of stock dividends.

It would seem possible to lay this down as a fundamental with regard to stock dividends: The total stock outstanding at the end of a dividend period should be at least as valuable per share as that outstanding at the beginning. In other words, if a corporation has a number of common shares outstanding on January 1, 1929, and declares common stock dividends during 1929 based on earnings during 1929 the total amount of stock outstanding on January 1, 1930, should, by reason of the reinvested earnings of 1929, be at least as valuable per share as the total outstanding on January 1, 1929. If this is not the case, the common stock dividends have created an impression of growth and increase in value, whereas as a matter of fact the dividends have merely been a dilution of the stock holdings.

The second problem—the increase to be made in capital by a corporation which declares regular or periodic stock dividends—may now be discussed in the light of the fundamental test just set forth above. This test is that the earnings justify such dividends. If that test is observed, there must of necessity be added to capital and surplus an amount necessary to justify such dividends. The essential point is that earnings which are used to indicate a growth should not be used again for the same purpose. Therefore earnings which are necessary to justify a stock dividend should be carried to capital. But it should be made clear that the capital increase has come about as a result of earnings. In fact, this capital is actually earned capital.

The distinction between capital, capital surplus and earned surplus has always been largely a matter of law. Today, with the development of no-par stock and stock with nominal par value, with the great latitude allowed directors in dividing capital funds between capital and surplus, with the latitude allowed in

**From an address at the annual convention of the Investment Bankers' Association, Quebec.*

making charges to capital surplus and earned surplus, the whole subject is in almost a hopeless tangle.

The third problem—the extent to which such dividends may be regarded as income by the individual or corporation receiving them—may become the most important and far-reaching problem confronting the investment world. No final conclusion can be reached at this time. In fact, probably no more can be said now than to state and comment upon the different views advanced.

In the first place, there is the view, already referred to, that common stock dividends are no more than additional pieces of paper. According to this view, the stockholder, after the stock dividend, owns precisely what he owned before, only he has more stock certificates to represent what he owns. If this view prevails, there is no problem; the importance and significance of stock dividends disappears.

It is not open to question that stockholders generally regard stock dividends as having some value, and even if some members of this association hold the opposite view, they must nevertheless analyze the views justifying this general attitude of stockholders.

At the outset it must be observed that there is much discussion as to whether a stock dividend is income. That there is income when it is sold there seems little doubt. Some hold that before sale it is merely enhancement of capital, but it is difficult to reconcile this view with the prevailing view that upon sale it is income. For the investor, whether it is called income or some form of gain not yet named is largely a matter of words. The essential thing from his viewpoint is whether he has something more than he had before.

We can now approach the question as to what value may properly be placed upon stock dividends by those receiving them—whether this value is income, or gain called by some other name. One view is that the recipient should not value the dividend higher than the declaring corporation has capitalized the dividend upon its books.

This presents the difficulty that all the capital applicable to common stock belongs pro rata to all the common stock, and no part can be made applicable solely to the stock declared as a dividend. If the earnings upon which the stock dividend is based are greater per share than the asset value of the existing common stock, the asset value of the existing stock is increased, but the asset value of the dividend stock is reduced below the amount carried to capital and surplus at the time the dividend is declared. It is urged in support of this view that when the stock dividend was declared, the directors in effect distributed to stockholders an amount equal in value to the earnings at that time carried to capital. The difficulty with this suggestion is that the corporation made no distribution of earnings to stockholders, but retained the earnings in the corporation for its development. Furthermore, the stockholders received no money, but merely stock certificates. The only basis upon which it may be said that the stockholders received the equivalent of the earnings is that common stock is worth its asset value. But it has long been recognized that asset value plays a small part in establishing the value of common stock. This subject was covered at some length earlier in this report. It is only by this fiction, which is contrary to fact, that this view can be supported.

Another view is that stock dividends should be valued by the recipient at the average cost of the stock upon which he received the dividend. This suggestion, which regards the same thing at the same time as bringing different values to different stockholders, arises, no doubt, from the practice of valuing inventories at cost or market, whichever is lower. This practice is an arbitrary method adopted in accounting in the attempt to determine realized profits for fixed periods in a going business. The suggestion that this practice be applied to stock dividends illustrates how far people have gone at this early stage of stock dividends in the fear that stock dividends will be over-valued.

A third view is that stock dividends should be taken at market value. In support of this view it is urged that this is the logical one to take, that it is in accord with the facts, and that it is the view which the stockholder himself naturally and reasonably takes. Furthermore, it is in accord with the fact that the value to the stockholder who retains the dividend is the same as to the stockholder who sells it. In electing to hold the stock, the stockholder has stock instead of cash. By electing not to sell, he does not change the nature of his gain nor the amount. Of course, from the moment that he elects to hold the stock, he runs the risk that the market value of his holding may go down or up, but this is no different from the risk attending the ownership of any other stock.

Utility Plans Not Affected by Stock Market

Samuel Insull and C. L. Edgar State that Utilities Will Proceed with Expansions Without Curtailment on Account of Collapse of Speculative Market

Samuel Insull

"THE Commonwealth Edison Company will spend $35,000,000 for new construction.

"The Peoples Gas Light & Coke Company is to spend $7,000,000 or $8,000,000.

"The Public Service Company of Northern Illinois will put $20,000,000 into new construction and extensions.

"The Middle West Utilities Company plans to spend $75,000,000 to $85,000,000 for new construction."

These statements, strongly repudiating any suspicion that the utilities with which he is identified contemplate any holding back in plans for immediate future development because of the late crash in the stock market, were made by Samuel Insull to the Chicago *Daily Tribune* early this week. This paper published expressions in similar tone from the heads of other businesses, railroading, banking, steel making, wholesaling, retailing, mail order, manufacturing, packing and agricultural, all of whom united in the belief, backed by plans of expansion, that the basic business temper of the country was not at all shaken by the behavior of the stock market.

To the direct question, "If there were danger of a business depression in the country or a panic, you would be considering holding back, wouldn't you?" Mr. Insull replied positively, "We most certainly would. But there isn't a suggestion of any need for holding back. We're going ahead."

Charles L. Edgar

"THERE seems to be no let up in power company growth either in the United States as an entirety or in the New England states. As a result of a recent questionnaire from the New England Council, it appears that over $60,000,000 is being spent by power companies in New England for improvements during this year.

"Although it is impossible to draw any exact conclusions, I am personally satisfied that the amount for 1930 will be considerably in excess of that for 1929. All this means that business in general in New England is in a healthy condition, and that the business of the power companies is becoming a greater factor in the development of New England industries as years go on. There seems to be no limit to the possibilities, and a man would be rash indeed who came to the conclusion that we had anywhere near arrived at saturation."

Furthermore, this view places the stockholder who retains his stock in the same position, with regard to the value of his stock, as the stockholder who sells the dividend and with the proceeds immediately purchases the same stock. Again it must be borne in mind that we are not discussing realized gains, but merely values. It is wholly illogical to say that a certificate of stock is not worth its market value, but that if sold and then repurchased, it would thereafter be worth its market value.

Those who hold the view that stock dividends should be regarded as worth the market price are aware that the stockholder who receives a large amount of stock and retains it has a real problem in determining its true market value before he acts on this unrealized value. For the stockholder who sells, there is no such problem; he discovers what the market value really is. The stockholder who retains his stock must consider the size of his holding in relation to the extent of the market, and make adequate reserves or deductions from apparent market value, before taking any action whatever based upon that value.

The view that stock dividends be valued at market does not necessitate the valuing of all stock at market and thus taking up periodically the market enhancement of the book value of stock. Stock dividends are to be taken at market only at the time of receipt. What is to be done with market enhancement from time to time is another question, and one which cannot be discussed in this extended report. It may be observed, however, that it appears to be the growing practice of soundly run corporations, owning market securities, to state publicly from time to time the market value of securities in relation to the value at which these securities are carried on the corporations published balance sheet.

There is a not unnatural fear that the growing practice of declaring stock dividends will result in too high values for common stock. If, however, the facts are all clearly set forth and if the principles for valuing common stock presented in the earlier part of this report are followed, it seems reasonably safe to leave to the buyers of stock the question as to whether prices are too high. Moreover, it must be borne in mind that even today we are inexperienced in valuing equities in a highly prosperous and growing business. Only a few years ago an investment world experienced only in bonds regarded asset value as all important in valuing common stocks, and we heard much of "watered stocks." Today we are deliberately capitalizing the future earnings in valuing common stocks. But we have much to learn regarding the sound basis of this valuation.

U.G.I. Exchange Offer Effective.—John E. Zimmermann, president of the United Gas Improvement Company, has announced that the exchange offer of the United Gas Improvement Company to owners of common stock, class B, and of common stock, class A, of the Commonwealth Utilities Corporation, had become effective, as such exchange offer had been accepted by the owners of the requisite number of shares of common stock, class B. This offer, which was made by U.G.I. on October 16, is for one share of U.G.I. and $11 in cash for each share of class B common stock of Commonwealth Utilities Corporation, and one share of U.G.I. for each share of class A, or non-voting common stock of the Commonwealth Corporation.

Canada's Potential 42,000,000 Hp.

Canada's known power sites aggregate 33,113,200 hp., available 24 hours a day, at 80 per cent efficiency, at the ordinary six months flow. The ratio of actual plant installation to theoretical power available indicates that the water-power resources of the Dominion as at present recorded will permit of a turbine installation of 42,000,000 hp. The existing total is only 5,349,232 hp. By far the larger portion of the developed power is in central electric stations. This industry in 1927 included 629 plants, with 4,173,349 hp. Fewer than half of them were hydraulic, but they accounted for 97.5 per cent of the total installed horsepower.

The industry's total generator rating was 3,385,227 kva. Total capital was $866,825,285; the year's revenue $104,033,297; expenses $60,169,781.

The recently published census of central electric stations in Canada for 1927 contains additional notes on Canadian water powers and a large amount of detailed statistical information regarding the electric light and power industry, by provinces.

Electricity from Volcanic Heat

Italy has 2,845,000 kw. in hydro-electric plants (1928), three-quarters being in northern Italy. In addition 686,752 hp. is directly applied in industry and commerce. Central-station thermal plants have 508,000 kw. installed and the industrials have 1,084,419 hp.

Unique power sources appear in the 1,531 hp. of wind motors, industrially applied, and 11,350 kw. in one central station operated by terrestrial heat. The latter is capable of vastly greater development, according to a recent statistical publication on the production of electrical energy issued by the Italian Government. The huge column of steam and hot gases from Mount Etna, it is stated, ought to furnish enough energy for the whole of Sicily. Apparently it is the intention to give serious attention to this source of power.

New Dividend Basis for Hydro-Electric Securities.—The Hydro-Electric Securities Corporation declared a quarterly dividend of 50 cents a share on the common stock payable December 14 to stock of record November 14. This places the common stock on a $2 per annum basis, against $1 previously.

401,692 Kw. Capacity in Coal Mining Plants

More than 1,500,000,000 kw.-hr., one-seventh of it purchased, was used in 1927 by coal mines in the United States that operated their own electric power plants. The average rating of these plants is about 800 kw., and the output is equivalent to full-load operation 3,240 hours a year, corresponding to a capacity factor of 37 per cent.

Isolated Coal Mining Electrical Plants —1927

Number of establishments	501
Generators:	
Number	1,074
Kilowatt capacity	401,692
Output, kilowatt-hours:	
Generated	1,298,641,149
Purchased	220,929,287
Total kilowatt-hours	1,519,570,436

Additional information is contained in the above table. No corresponding statistics are at present available for mines using purchased energy exclusively.

National Public Service Corporation Declares Initial Dividend.—National Public Service Corporation has declared an initial dividend of 75 cents a share on the class B common stock, payable November 1, 1929, to stock of record October 15. The company announced an intention to pay dividends hereafter at the rate of 25 cents per quarter, the first quarterly dividend to be paid on February 1 to stock of record January 15, 1930, if the present plans can be carried out as expected.

Utility Company Extends Subscription Date.—Sierra Pacific Electric Company announces an extension until January 3 of the time within which subscription and payment may be made for common stock of the company offered to stockholders of record October 14 at $40 per share. Notwithstanding the statement on the face of the warrants that rights are void after November 4, 1929, the rights will continue in effect to and including January 3.

American Power & Light Declares Special Dividend.—Directors of American Power & Light Company have declared a special dividend of five-fiftieths of a share (10 per cent) in common stock for payment December 2 to common-stock holders of record at the close of business November 15. A dividend of the same amount was paid by the company December 1 of last year. The dividend just declared is in addition to the regularly quarterly cash dividend of 25 cents a share and the regular semi-annual stock dividend of one-fiftieth of a share (2 per cent) in common stock payable December 1.

Business News and Market Conditions

N.E.M.A. Appoints Chairmen and Section Officers

The National Electrical Manufacturers' Association announces the election of new chairmen and other officers of the following sections:

Fan Motor—E. L. Barkhouse, Emerson Electric Manufacturing Company, Inc., St. Louis, chairman; L. L. Goding, Wagner Electric Corporation, secretary.

Manufactured Electrical Mica—Thomas Allen, Macallen Company, Boston, chairman.

Vulcanized Fiber—J. K. Johnston, National Vulcanized Fiber Company, Wilmington, secretary.

Industrial Lighting—G. J. Henry, Wheeler Reflector Company, Boston, chairman; D. E. Worrell, Quadrangle Manufacturing Company, Chicago, secretary.

Air Circuit Breaker—R. A. Neal, Westinghouse Electric & Manufacturing Company, East Pittsburgh, chairman; A. W. Lundstrom, General Electric Company, Philadelphia, secretary.

Motor and Generator—Charles F. Norton, Howell Electric Motors Company, Howell, Mich., chairman; L. J. Osborn, Fairbanks, Morse & Company, Chicago, vice-chairman; W. A. Black, Fairbanks, Morse & Company, Chicago, secretary.

Small Circuit Breaker Group of the Air Circuit Breaker Section—C. A. Bates, Bryant Electric Company, Bridgeport, Conn., chairman.

Carbon—H. C. Mills, Morganite Brush Company, Long Island City, N. Y., secretary.

Industrial Control—F. W. Magin, Square D Company, industrial controller division, Milwaukee, chairman.

Panelboard and Distribution Board—Arthur J. Pringle 2d, Pringle Electric Manufacturing Company, Philadelphia, chairman; H. E. Ruggles, Westinghouse Electric & Manufacturing Company, East Pittsburgh, secretary.

Attachment Plug—R. M. Eames, Bryant Electric Company, Bridgeport, Conn., chairman.

Non-Metallic Conduit—D. H. Murphy, Wiremold Company, Hartford, Conn., chairman.

Rigid Conduit—F. W. Hall, General Electric Company, Bridgeport, Conn., chairman; H. S. Walker, Walker Brothers, Philadelphia, secretary and treasurer; George H. Sicard, Utica, N. Y., executive secretary and assistant treasurer.

Electrical Exports Up 77 per Cent

Exports of electrical equipment during September were 77 per cent greater than for September, 1928, and 10 per cent over the total for October of this year.

Figures for September show very substantial increases in the case of basic equipment such as generators and motors. Direct-current generators under 500 kw. increased from $50,050 in September, 1928, to $112,502, while exports of alternating-current generators of 2,000 kva. and over expanded from $2,500 to $129,349. Radio apparatus showed a further substantial gain as well.

From a standpoint of destination of these exports Canada, as usual, took nearly one-third. Next in order of value of purchases were the United Kingdom, Australia, Argentina and Mexico.

The continent of Europe purchased $2,459,164 worth and Asia, Africa and Oceania $3,719,763.

Exports of Electrical Equipment (Preliminary)

Article	September 1928	September 1929
Generators:		
Direct current—		
Under 500 kw.	$50,050	$112,502
500 kw. and over..	7,424	42,516
Alternating current—		
Under 2,000 kilovolt-amperes	10,076	35,496
2,000 kilovolt-amperes and over	2,500	129,349
Steam turbo-generator sets	44,036	39,336
Accessories and parts for generators	54,559	115,125
Self-contained lighting outfits	68,993	106,535
Batteries:		
Flashlight batteries	209,850	239,830
Other dry and wet cell primary batteries	151,282	
Radio B and C batteries (dry)		110,397
Other, not elsewhere specified		138,102
Storage batteries	199,949	320,111
Transforming or converting apparatus:		
Power transformers, 500 kilovolt-amps. and over	74,223	56,305
Distribution transformers, less than 500 kilovolt-amperes	73,273	104,380
Instrument transformers	4,313	3,033
Other transformers, not elsewhere specified	35,880	187,571
Complete battery chargers under 15 amp.	27,047	21,386
Rectifiers, double-current and motor generators, dynamotors, synchronous, and other converters	27,153	69,699
Transmission and distribution apparatus:		
Switchboard panels, except telephone	35,083	77,949
Switches, and circuit breakers over 10 amp.	94,447	225,743
Fuses and fuse blocks	32,903	47,886
Watt-hour and other measuring meters	47,293	79,133
Electrical indicating instruments	39,758	71,203
Other electrical testing apparatus	66,416	76,259
Lightning arresters, choke coils, reactors, and other protective devices	33,011	101,463
Motors, starters, and controllers:		
Motors, ⅛ hp. and under	145,787	222,587
Motors, over ⅛ and under 1 hp.	$38,479	$57,022
Stationary motors—		
1 to 200 hp.	183,140	330,204
Over 200 hp.	27,853	51,174
Railway motors	100,899	2,048
Electric locomotives—		
Railway	13,391	
Mining and industrial	3,085	42,212
Station and warehouse electric motor trucks	5,484	7,783
Starting and controlling equipment—		
For industrial motors	95,062	143,622
For electric railway and vehicle motors	58,020	8,389
Portable electric tools	70,887	
Portable electric tools, except automotive		84,638
Automotive electric machine tools		5,751
Accessories and parts for motors	130,628	287,212
Electric appliances:		
Electric fans	44,738	102,116
Electric lamps—		
Metal filament	67,025	126,041
Other electric lamps	45,355	41,259
Flashlights	137,244	193,283
Searchlights and projectors	46,506	38,211
Motor-driven household devices—		
Electric household washing machines	156,034	208,268
Electric vacuum cleaners	56,051	101,753
Other motor-driven devices, except tools	77,673	102,975
Electric flatirons	21,587	27,518
Electric cooking ranges	14,038	21,387
Other domestic heating and cooking devices	69,212	90,870
Industrial electric furnaces and ovens	25,070	70,289
Therapeutic apparatus, x-ray machines, galvanic and faradic batteries, etc	119,296	148,699
Signal and communication devices:		
Radio apparatus—		
Transmitting sets and parts	65,056	221,790
Receiving sets	492,954	1,211,719
Tubes	62,032	149,190
Receiving-set components	311,003	514,492
Other receiving-set accessories	266,203	
Loudspeakers		$224,474
Other receiving-set accessories, not elsewhere specified		306,171
Telegraph apparatus	$69,562	79,943
Telephone apparatus—		
Telephone instruments	34,926	58,311
Telephone switchboards	26,124	212,255
Other telephone equipment	112,912	341,906
Railway signals, switches, and attachments	36,987	258,365
Bells, buzzers, annunciators, and alarms	26,591	38,105
Other electric apparatus:		
Spark plugs	136,364	156,790
Other starting, lighting and ignition equipment	108,226	155,817
Insulating material	67,895	117,652
Metal conduit, outlet, and switch boxes	84,195	130,310
Sockets, receptacles, and lighting switches	157,538	164,966
Electric interior lighting fixtures	145,979	197,651
Electric street lighting fixtures	35,294	41,856
Other wiring supplies and line material	64,541	131,465
Other electrical apparatus, not elsewhere specified	507,441	1,148,703
Rubber and friction tape	27,902	39,021
Globes and shades for lighting fixtures	40,141	66,248
Electrical glassware except for lighting	34,333	14,685
Electrical porcelain:		
For less than 6,600 volts	48,916	98,041
For 6,600 volts and over	59,658	57,831
Carbons, carbon brushes, and electrodes:		
Electrodes for electric furnaces	131,449	154,976
Other carbon products	43,973	81,794
Insulated iron or steel wire cable	7,398	40,152
Copper, bare wire	92,337	348,687
Copper, insulated wire and cable	485,327	461,876
Refrigeration sets up to 1 ton capacity	467,513	
Refrigeration sets up to ½ ton capacity		660,038
Refrigeration sets over ½ to 1 ton capacity		182,221
Totals	$7,400,973	$13,116,894

Market Conditions

ELECTRICAL EQUIPMENT BUSINESS on the Pacific Coast is up to normal, although coming orders will depend on the effect of the market break. Transformers and distribution equipment are active, but there is some slowing down in inquiries.

——DISTRIBUTION EQUIPMENT IS ACTIVE in the Middle West and railroads are purchasing heavily. Medium-sized miscellaneous apparatus is moving steadily in the St. Louis area.

——CENTRAL-STATION AND MARINE BUSINESS show activity in the East. Electric railway orders are falling off somewhat.

EASTERN

THERE are no noticeable changes in sight in the market for electrical equipment in the Eastern district. Good demand and sizable commitments continue to rule.

CENTRAL-STATION requirements are prominent in the current call, with industrial account a close second.

ELECTRIC RAILWAY business shows a tendency to ease for the time being, but marine equipment is again in demand, with the outlook distinctly favorable.

A feature of the week's sales is the contract secured by the Westinghouse Electric & Manufacturing Company for complete equipment for two super-passenger vessels now being constructed by the Newport News Shipbuilding & Dry Dock Company for the Dollar Line, including turbo-generators to develop 26,500 shaft-horsepower, propelling motors for the twin screws, control apparatus for propelling machinery, motors and controls of electrified deck and underdeck auxiliaries.

A manufacturer of heavy electrical machinery in New Jersey reports sales as brisk at the present time, with bookings in advance of this month last year; orders on hand insure capacity for some weeks to come. A Northern New York power company has placed a contract with a state manufacturer for a quantity of motors and control equipment to cost $90,000. A power interest in West Virginia has purchased motor-generator sets, transformers and switchgear from a New York maker, totaling about $100,000. A utility company in Ohio has closed for transformers and switchgear to cost approximately $25,000. A metropolitan central station has contracted for a quantity of transmission cable to an amount of $100,000. An award for transformers, switching equipment and auxiliary apparatus for a substation installation in West Virginia has been divided between a New York manufacturer and a Middle West producer, totaling close to $70,000. A maker of high-tension switches and kindred equipment reports a slight decline in business as compared with this time a year ago, and attributes it to the decline in the stock market; trade is said to be good with utility companies. A manufacturer of transformers states that orders are running in small amounts but volume business is exceeding that of a year ago; the majority of transactions are with central stations and industrial account shows inclination to lag.

Motors and controls are in fair demand by the industrials, with iron and steel mills, machinery manufacturers and other branches of the metal working industries taking a large quota of the commitments. A manufacturer of compressors in Connecticut has purchased equipment of this kind from a New York manufacturer to the sum of $40,000; a rayon mill in northern New York has ordered motors and controls to the amount of $65,000. Jobbers of electrical equipment say that trade has a tendency to be spotty; the outlook for holiday business is not as bright as a fortnight ago, retailers showing hesitancy in placing immediate orders.

CONSTRUCTION PROJECTS

Union Carbide & Carbon Corporation, New York, will carry out an expansion program at its carbide plant at Niagara Falls, N. Y., as well as at ferro-alloy mill at Glen Ferris, W. Va., reported to cost more than $600,000. Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa., will soon takes bids on general contract for proposed factory branch and service plant at Newark, N. J., to cost close to $500,000. Boyce-Thompson Institute, Yonkers, N. Y., will take bids for a laboratory addition to cost $400,000. General Electric Company, Schenectady, N. Y., plans factory branch, storage and distributing plant at Minneapolis, Minn., to cost $450,000. State Board of Education, Trenton, N. J., will build a power plant at proposed normal school at Hillwood Lakes, entire project to cost $985,000. Bayway Terminal Company, Bayway, Elizabeth, N. J., plans addition to cotton warehouse and storage to cost more than $400,000. John A. Roebling Sons' Company, Trenton, N. J., will begin superstructure for addition to wire mill to cost $200,000. Bureau of Supplies and Accounts, Navy Department, Washington, D. C., will receive bids until December 3 for twelve motors, controllers, switches, spare parts, etc., for the Philadelphia navy yard (Schedule 2283); also, at same time for one 100-hp. motor and one drum-type controller for same yard (Schedule 2264). Duquesne Light Company, Pittsburgh, Pa., plans pumping station and water-treating plant at generating plant at Brunot Island, to cost $290,000. Titusville Iron Works, Inc., Titusville, Pa., plans addition to foundry to cost $200,000. Consolidated Gas, Electric Light & Power Company, Baltimore, Md., plans submarine 33,000-volt transmission line to Point Breeze section for industrial service, estimated to cost $120,000. St. Paul Garage Company, Baltimore, Md., has plans for a service, repair and garage building to cost $1,000,000. Bureau of Yards and Docks, Navy Department, Washington, D. C., will receive bids (no closing date stated) for automatic refrigerating machines for naval hospital at Portsmouth, N. H. (Specification 5981.)

SOUTHEAST

LITTLE CHANGE is to be noted in general conditions in the Southeast, the small orders coming through in satisfactory volume and the large buyers marking time.

A power company in Louisiana ordered last week large power transformers amounting to approximately $200,000 and small turbine units amounting to $50,000. A Tennessee company with a water-power development over the line in Georgia ordered a 20,000-kva. motor-generator set for that plant. One company's cable orders last week aggregated $11,100 and its pole and pole line hardware orders totaled $8,900. Some other central-station orders were for $3,900 of conduit, $3,600 of distribution transformers and $3,100 of relay equipment. Contracts were let last week on a Georgia cotton mill electrification project and orders were placed for motors, transformers and switchboard equipment aggregating $18,000 and wiring materials approximating $5,000. The power company to serve this plant will order a 1,000-kva. transformer substation for installation at this plant. A street-lighting equipment order placed last week amounted to $3,500. Merchandising activities of central stations continue brisk, one company having last week closed a two weeks' radio campaign with 1,318 radio set sales.

CONSTRUCTION PROJECTS

South Hill, Va., contemplates the installation of floodlighting system and beacon lamps at proposed municipal airport. Kentucky Utilities Company, Louisville, Ky., has authorized early construction of transmission line from Shelbyville to Carrollton, Ky., about 34 miles, reported to cost about $75,000. Colonial Baking Company, Memphis, Tenn., plans electric operated baking plant to cost $300,000. Procter & Gamble Company, Cincinnati, Ohio, has approved plans for plant at Memphis, Tenn., for sheeting chemical cotton for rayon use, to cost $1,000,000. Longview Hosiery Mill Company, Hickory, N. C., will build an addition to cost $140,000. Blancolit Manufacturing Company, Greenville, S. C., will build an addition to bleaching and finishing process plant to cost $250,000. White Packing Company, Montgomery, Ala., plans meat packing plant to cost $200,000. Sheffield, Ala., plans installation of floodlighting system and beacon lamps at proposed municipal airport. Griffin Cotton Mills, Inc., Griffin, Ga., will build an addition to cost about $350,000.

Florida Power Corporation, St. Petersburg, Fla., contemplates extensions in transmission lines in the vicinity of Dunnellon, Fla.

Middle West

GENERAL business in the Middle West section continues to show improvement, the volume of business is quite substantial and an optimistic feeling is prevalent.

MAJOR activities still remain in a good position, while some slight encouragement is obtained from construction activities.

RAILROADS are continuing their purchasing of equipment and the various utility companies are busy with fall construction programs, confidently, although conservatively, preparing for increased business.

Demand for distribution equipment is quite heavy, some of the interesting orders placed this week including one for oil circuit breakers to cost $135,000, one for 565 Thompson meters, 5 to 2000 amp. capacity, and several construction orders aggregating $100,000.

Considerable activity is evidenced in jobbing circles as the holiday season approaches. Plans are being formulated to again advance the slogan this year "Give something electrical" for Christmas.

CONSTRUCTION PROJECTS

Kimberly-Clark Company, Neenah, Wis., plans addition to paper mill at Kimberly, Wis., to cost about $100,000. Western Printing & Lithographing Company, Racine, Wis., plans plant to cost $100,000. Great Northern Railway Company, Minneapolis, Minn., plans grain elevator at Superior, Wis., to cost $450,000. Chevrolet Motor Company, Detroit, Mich., plans addition to plant at Bay City, Mich., reported to cost more than $200,000. Checker Cab Company, Kalamazoo, Mich., will build taxi cab manufacturing plant to cost more than $250,000. Consumers Power Company, Jackson, Mich., plans two-story addition to steam-operated electric power plant at Kalamazoo, Mich., reported to cost $350,000. Clarke Sanding Machine Company, Chicago, Ill., will build plant at Muskegon, Mich., to cost more than $150,000. Hume Pipe Corporation, Chicago, Ill., plans reinforced concrete pipe manufacturing plant at Arlington Heights, Ill., to cost $100,000. Faith Manufacturing Company, Chicago, Ill., has approved plans for plant for manufacture of automobile equipment, to cost $200,000. Corman Aircraft Corporation, Auburn, Ind., has plans for airplane manufacturing plant and power plant at Connersville, Ind., to cost $150,000. Union Malleable Manufacturing Company, Ashland, Ohio, will make additions in plant to cost more than $75,000. Fairmont Creamery Company, Cleveland, Ohio, plans storage and distributing plant to cost about $500,000. Holophane Glass Company, Newark, Ohio, is completing plans for plant addition to cost $80,000. Brainard Steel Company, Warren, Ohio, plans expansion and improvement program to cost $300,000. Truscon Steel Company, Youngstown, Ohio, will make extensions in mill to cost about $300,000. Fairmont, Minn., plans installation of floodlighting system and beacon lamps at proposed municipal airport. Red Wing, Minn., contemplates a municipal electric light and power plant, reported to cost more than $70,000. St. Paul, Minn., plans municipal airport with hangars, shops, power house and other buildings, to cost $100,000. Lincoln, Neb., will soon take bids for stokers, economizers, superheaters and other power equipment for municipal service. Interstate Power Company, Dubuque, Iowa, will proceed with superstructure for equipment storage and distributing plant to cost about $40,000.

Southwest

SO FAR this year the particularly marked feature of electrical business has been the almost unequaled steady demand for medium sizes of apparatus. Most of these sales have been for extensions in going manufacturing concerns and new industries.

POWER COMPANIES report an increase in industrial sales of current around 15 per cent over ten months of last year.

Jobbers and manufacturers' agents have been doing a good volume of business in new radio models and all types of appliances. No large contracts have been closed the past week.

CONSTRUCTION PROJECTS

Wood Brothers, Inc., Kansas City, Mo., is completing plans for aircraft manufacturing plant at St. Joseph, Mo., to cost $300,000. The Missouri Power & Light Company, Kansas City, Mo., is reported planning power substation in vicinity of Macon, to cost about $200,000. Grand Hydro-Electric Corporation, Ritz Building, Tulsa, Okla., plans hydro-electric power plant on Grand River, Mayes County, Okla., to cost $1,000,000. Maverick County Water Improvement District, Eagle Pass, Tex., plans hydro-electric power plant to cost $1,000,000. International Harvester Company, Chicago, Ill., plans factory branch, assembling and distributing plant at Sweetwater, Tex., to cost about $100,000.

New England

BUYING in New England proceeds with little letdown.

OPINION is quite general that conditions in the electrical market are more favorable now than at this time last year.

INDUSTRIAL equipment buying is active and has made an outstanding gain in sales volume over that reported a year ago.

During the past week motor sales continued steadily; orders are numerous, but in small lots. Industrial expansions in small northern New England factories are numerous. One public utility reports load additions ranging from 10 hp. up. Small switch and control equipment orders maintain a constant level; large power equipment sales include two 15,000-kw. turbo-generator units to be placed in Southern utility plant. Arc-welding units are in demand. Recently a large industrial plant placed orders amounting to about $30,000 for arc-welding equipment and accessories.

Central-station supplies are spotty; line extensions are soon to be commenced in many localities in northern New England. Electric floodlighting is active; installations for night lighting of athletic fields are gaining. Recently one such requiring 8,000 watts for a Vermont school was placed. The trend in merchandising is encouraging; the gain in volume over the previous week was about 15 per cent.

With reference to the situation for the coming year, a prominent utility official announced that $60,000,000 was spent for electrical equipment in New England during the past year; next year, in his opinion, as large an amount, at least, will in all likelihood be spent for further advancement of the industry.

CONSTRUCTION PROJECTS

New Hampshire Sanitorium, Warren, N. H., plans hydro-electric power plant for service at institution to cost about $50,000 Edison Electric Illuminating Company, Boston, Mass., has filed plans for a power substation at Woburn, to be known as substation No. 211, reported to cost more than $40,000. Boston & Maine Railroad Company, Boston, Mass., will build a mechanical cooling and freezing plant at Worcester, to cost about $65,000. Walker Ice Company, Worcester, Mass., has filed plans for ice-manufacturing plant to cost about $50,000.

Pacific Coast

BUSINESS for the next six months will depend upon reaction from the recent market drop.

MAINTENANCE and construction economies are forecast by some observers, but the prevailing opinion is that another dry winter and ripe business in areas now being tapped by distributing lines will continue construction projects with unabated energy.

The past week's inquiries from power companies include $14,000 worth of bare copper wire, $13,000 worth weatherproof wire, $6,000 worth 15,000-volt, three-conductor No. 2 stranded-lead cable, six assorted carloads of poles, mainly 7 in., 30 ft. machinery orders are poor, the outstanding order covering $25,000 worth of General Electric reactors for the Pacific Gas & Electric Company. General Electric also reports $2,000 worth of air circuit breakers. Industrial business has been noticeably affected by the stock market, the only order of any size covering $15,000 worth of Westinghouse paper mill equipment for Portland. Other industrial orders cover a carload of conduit for an elevator company and a carload of wire for an oil company. Southern California projected work includes a $10,500,000 airport terminal for Los Angeles, including a 160x1,005-ft. industrial building, a $200,000 pumping plant irrigation system for Riverside and a $1,000,000 narcotic hospital for Riverside. Other prospective business includes an 18-mile 38,000-volt connecting line from Klamath Falls to Bonanza, in the district which promises

to be a battleground for railroad business, and a $3,500,000 tin plate mill for Pittsburgh.

An unexpected volume of motor sales was reported last week in the Puget Sound area, the majority of buying being from sawmill manufacturing organizations, installations to be made in lumber mills during annual Christmas shutdown. One Seattle jobber reported sale of 60 motors from 60 hp. down, another twenty from 100 hp. down and another 25 from 75 hp. down. Numerous inquiries from mills for machines from 300 hp. down were received. Central station buying in the Puget Sound district included one 15,000-volt and one 73,000-volt, outdoor type oil circuit breakers and about $7,000 worth of miscellaneous switchgear. The city of Seattle will take bids shortly for one 210-amp.-hour control battery for installation at Cedar Falls. Contract for driving, piling and foundation work on the proposed $800,000 first unit of the new plant of the New Westminster Paper Company, Ltd., at New Westminster, B. C., was let and specifications for electrical apparatus and motors are expected shortly. The Canadian Pacific Railway, Victoria, B. C., let the contract for a $600,000 power house and steam laundry in Victoria.

CONSTRUCTION PROJECTS

Fresno, Calif., contemplates installation of improved electric fire alarm system, to cost more than $100,000. Minerals Increment Company, J. Ralph McInerny, 1400 East Sixth Street, Los Angeles, Calif., plans light metal manufacturing plant at Pittsburg, Calif., to cost $200,000. Western Sugar Refining Company, San Francisco, Calif., plans storage and distributing plan to cost $200,000. Van de Kamp Holland Dutch Bakers, Los Angeles, Calif., plans baking plant to cost $300,000. Sacramento, Carlsbad, Santa Cruz and Oakland, Calif., plan ornamental lighting systems. Mutual Income Properties, Inc., Los Angeles, Calif., will build a cold storage warehouse and refrigerating plant, to cost $1,000,000. Hughson Milk Company, Hughson, Calif., will build three-unit plant to cost $85,000. Los Angeles, Calif., is considering installation of improved type of electric traffic signal system. San Joaquin Light & Power Corporation will build a new hydro-electric power plant at Merced Falls, near Merced, Calif. to cost $325,000. Pacific Iron & Steel Company, Los Angeles, Calif., plans plant at Compton, Calif., to cost $250,000. Horlucks, Inc., Seattle, Wash., plans ice cream and baking plant to cost $175,000. Henry McCleary Timber Company, Shelton, Wash., has authorized construction of 18 mi. of 44,000-volt transmission line and power substation for service at mill. Washington Box & Veneer Company, Puyallup, Wash., plans fruit and vegetable container plant at Seattle, to cost more than $100,000. Idaho Falls and Moscow, Idaho, plan installation of flood lighting system and beacon lamps at proposed municipal airports. University of Utah, Salt Lake City, Utah, plans engineering building to cost $400,000. Public Service Company of Colorado, Denver, Colo., plans extensions and improvements in steam-operated electric power plants at Leadville, Alamosa, Grand Junction and Sterling, reported to cost $450,000. Colorado Fuel & Iron Company, Pueblo, Colo., has authorized the electrification of coal mining properties at Crested Butte.

Activities of the Trade

Claude Neon Merger

Claude Neon Electrical Products Corporation of Oregon has consolidated with the Claude Neon Electrical Products Corporation, Ltd., of Delaware on the basis of three shares of the Delaware corporation stock for five shares of the Oregon company. As a result of the merger, the company has declared a special dividend of 2 per cent in stock and between 35 cents and 45 cents in cash on common stock, payable January 1 to stock of record December 19. Special common dividends are in addition to regular common dividends payable January 1. Net income of Claude Neon Electrical Products of Delaware for nine months ended September 30 was $550,297 after charges and federal taxes.

McDonald Engineering Laboratory

For the first time executives in American industry are to have the advantage of a central, independent engineering laboratory for the display and practical demonstration of industrial machinery under actual working conditions. This project, indorsed by the Boston banking house of Kidder, Peabody & Company and sponsored by McDonald Brothers, Inc., industrial engineers, will see fulfillment in a $3,000,000 laboratory building, containing more than 500,000 sq.ft. of floor space, to be erected in Detroit, and known as McDonald Brothers Engineering Laboratories.

While the idea of a centralized market for the display of industrial equipment and machinery is not new, the present project is unique in a number of important points. It is planned to duplicate true factory operating conditions, with the equipment of exhibitor members operating on actual work. A competent engineering staff will be connected with the laboratories to demonstrate equipment or assist the sales representatives of members in so doing.

Electric Auto-Lite Reports Increased Business

October business of the Electric Auto-Lite Company was 27 per cent greater than September, establishing the largest October volume in the history of the company, according to a statement made by C. O. Miniger, president. This record business was done despite the fact that parts and accessories production generally during October was about 10 per cent under the previous month. Mr. Miniger stated that the October business was 15 per cent greater than the same month of last year and three times as great as in October, 1927, and five times as much as October, 1926. With schedules for November and December highly satisfactory, Mr. Miniger said that indications are that the fourth quarter will be the best fourth quarter ever experienced by the company.

Westinghouse to Build Large Synchronous Converters

The Roessler & Hasslacher Chemical Company of Niagara Falls has recently ordered two 16,000-amp., 340-volt direct-current synchronous converters from the Westinghouse Electric & Manufacturing Company. These machines will have the largest current rating of any converting equipment in electrolytic service, increasing by 60 per cent the current rating of any previously installed converter used for this purpose. Switching equipment for the converters and two 5,800-kva., three-phase transformers with tap changers were also included in the order.

The synchronous converters will be of the fabricated type, being shunt wound and having a voltage variation by means of field control. The converters will be interlocked with the switching to prevent improper starting and to insure the connection of the proper polarity to cell circuit. An interesting feature of this equipment is that it will run continuously at full load 24 hours a day.

CANADIAN GENERAL ELECTRIC COMPANY has appointed R. M. Elgar sales engineer with headquarters in Vancouver, B. C.

AMERICAN CABLE COMPANY, handling sales and service on "Tru-Lay" wire rope and "True-Loc" fittings in the Chicago region, has moved from 160 North La Salle Street to the Chicago Daily News Building, 400 West Madison Street.

AMERICAN CONCRETE MARBELITE COMPANY has been formed through the merger of the American Concrete Products Company, Chicago Concrete Post Company and Marbelite Corporation of Illinois with a plant at Waukegan. The new company will have offices in Chicago and plants in Chicago and Waukegan.

ELECTRICAL DIVISION, COMMERCE DEPARTMENT, Washington, D. C., will undertake a national survey of the distribution of electric refrigerators and electric heating appliances as soon as it completes its distribution study of radio sets. The final analysis of the radio study is in process of completion and it is expected that the census of heating appliances and refrigerators will be well under way by January 1.

New Equipment Available

Sectional Electric Range

A new electric kitchen range which can be built up or taken down at will like a sectional bookcase is introduced by the Armstrong Electric & Manufacturing Company, Huntington, W. Va. The complete unit comes in sixteen parts, making the same range readily adaptable to the larger and to the smallest houses and apartments.

One of the new ranges is convertible into 50 different styles by shifting the parts to suit the various demands of the user.

Remote Type Recording Instruments

The Brown Instrument Company of Philadelphia has brought to completion the development of a new line of instruments for indicating, recording and controlling various factors at long distances. Ordinary pressure gages are now designed to work effectively at very long range. Yet for many purposes there exists an urgent need for instruments that can be relied on to indicate, record or control pressures and other factors dependably over distances of several hundred feet and up to 30 miles.

All of these instruments are made to operate on the inductance bridge principle, adapting this method of transmitting motion to use with various elements in their respective instruments in such manner as to transmit impulses properly corresponding with the fluctuating in the factors to be indicated, recorded or controlled. The line now includes instruments for indicating, recording or controlling at long distances pressures, flows, liquid levels or special data involving the position or motion of a member or element requiring observation or control at a distance. The latter applications are taken care of by the adaptation of the Brown motion transmitter, a new Brown instrument belonging to this remote type line.

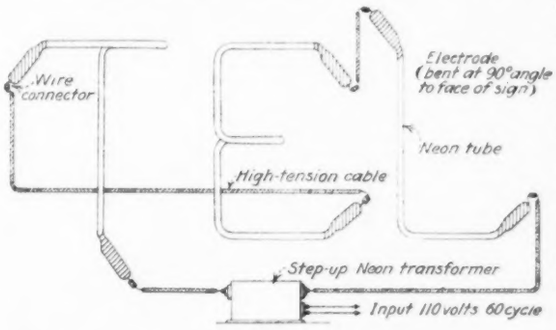
A New Type of Floodlighting intended for cornice, relief and outdoor home lighting is announced by the General Electric Company. It is suitable for mounting on the top of a cornice to eliminate the shadow created from floodlights mounted below and has a low mounting height so that it will not be conspicuous along the cornice. This new floodlight, type L-32, has a wide light distribution, effective for short range floodlighting.

White Light from Electrified Gaseous Tubes

The production of white light by the Neon system of lighting is announced by Claude Neon Lights, Inc., 41 E. 42d Street, New York City. The importance of this development lies in the efforts of lighting engineers to secure the greatest efficiency for electric energy expended.

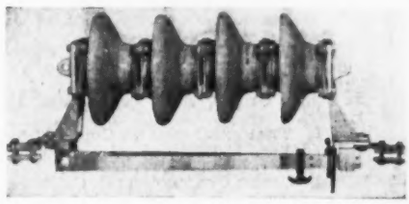
In the tube type of electric light advantage is taken of the fact that the inert gases of the atmosphere are conductors of electricity under low pressures and high voltages. They can be controlled in intensity and color. The difficulty with the white tube was to secure proper gas to give an optically clear white which would have sufficiently long life to be commercially practical. By the even distribution of light it is claimed there is practically no waste and great visibility is secured with less actual candlepower than is required when using lamps at fixed centers. The new light is comparatively a cold light and as such is adaptable to under-water illumination and should withstand severe weather.

It is claimed that previous systems involving tubes with carbon dioxide gas used high voltage, high current and the tubes grew very hot and used considerable electric current. The Claude white tubes use inert gases rather than active gases. They have a life of upward of 1,500 hours. According to the manufacturer, they use high voltage, low current and require no valve arrangement to refill the tube.



Suspension Type Switch Is Line Hook-Stick Operated

A new suspension type line hook-stick-operated disconnecting switch has been developed by the Champion Switch Company, Kenova, W. Va. The interchangeable units are shunted by a reinforced truss blade, which is in turn provided with blade guides, lugs and compression type solderless connectors. It is made in various voltages and in a wide range of ampere capacities.



A Water System with constant pressure for country or suburban homes and for many rural needs is announced by the Westinghouse Electric & Manufacturing Company. These automatic electric systems consist of a tank and pumping equipment. A Westinghouse type AR heavy-duty motor operates the double-acting reciprocating pumps. The system is completely automatic. Three mechanical "guardsmen," the automatic electric pressure switch, the automatic air volume control and pressure gage and the automatic circuit breaker keep constant watch and control the system.

Non-Corrosive Raceway for Under-Floor Wiring

A non-corrosive raceway for underfloor wiring in concrete floors, known as "G-E Fiberduct," is announced by the General Electric Company, merchandise department, Bridgeport, Conn., is so designed that neat-appearing outlets may be installed safely and economically at any point and at any time during the life of the building.

This raceway is composed of impregnated fiber. The wall thickness is $\frac{3}{16}$ in. and the cross-sectional area is 3 square inches. The duct is oval in shape, so that when concrete is poured over it an arch is formed, assuring maximum strength. This shape offers the added advantage of minimum height making it ideal for use where space between floors is limited.

Another feature of this new system is the cast-iron, rust-resisting junction box equipped with an adjustable brass cover.

A line of brass surface fittings permits outlets to be established when and where they are required. The system is adapted equally well for cinder fill or monolithic (one-layer) construction.

Electrical Patents

Announced by U. S. Patent Office

(Issued October 22, 1929)

1,732,917. ELECTRIC FURNACE; D. L. Summey, Waterbury, Conn. App. filed July 28, 1923.

1,732,927. CABLE CONNECTOR; L. H. Church, Elizabeth, N. J. App. filed Nov. 12, 1926.

1,732,929. ELECTRIC REGULATION; J. L. Creveling, Oracle, Ariz. App. filed May 21, 1924.

1,732,937. TRANSFORMER AND COIL SYSTEM; L. L. Jones, Oradell, N. J. App. filed June 1, 1927.

1,732,956. CABLE CONNECTER; G. C. Thomas, Jr., Elizabeth, N. J. App. filed July 26, 1926.

1,732,977. CIRCUIT PROTECTION; O. Mayr, Karkshorst, Germany. App. filed Mar. 3, 1926.

1,732,984. LEAD OR LIKE METAL SHEATHED ELECTRIC CABLE; J. L. Packer, Huyton, England. App. filed Aug. 4, 1925.

1,732,987. TELEMETRIC SUMMATION SYSTEM; R. M. Rowell, Lynn, Mass. App. filed Mar. 9, 1927.

1,733,000. SERIES RECEPTACLE; P. S. Bailey, Marblehead, Mass. App. filed April 17, 1924.

1,733,017. ELECTRIC SWITCH; J. D. Hilliard, Schenectady, N. Y. App. filed Jan. 2, 1924.

1,733,023. ADJUSTABLE HIGH OHMIC RESISTANCE AND METHOD OF MANUFACTURING SAME; J. Kremenezky, Vienna, Austria. App. filed July 11, 1928.

1,733,033. FLYING MACHINE; H. Steigner, San Francisco, Calif. App. filed Jan. 4, 1929.

1,733,039. LOCKING LAMP RECEPTACLE; F. H. Weston, Schenectady, N. Y. App. filed June 9, 1921.

1,733,045. REMOTE-CONTROL SYSTEM; W. R. G. Baker, Schenectady, N. Y. App. filed Dec. 29, 1925.

1,733,047. SIGNAL LAMP; P. P. Basterreix, Butte, Mont. App. filed Sept. 13, 1927.

1,733,067. INSULATOR; R. H. Marvin, East Liverpool, O. App. filed May 10, 1922.

1,733,074. ELECTRIC DRIVE; R. Riecke, Charlottenburg, Germany. App. filed Sept. 1, 1925.

1,733,076. FILAMENT SUPPORT AND METHOD OF MAKING IT; C. J. Smithells, Bushey, England. App. filed April 25, 1927.

1,733,077. HIGH-POTENTIAL SWITCHING STATION; R. M. Spurck, Schenectady, N. Y. App. filed Jan. 31, 1927.

1,733,085. ELECTRIC THERMOSTAT; A. A. Thomas, New York, N. Y. App. filed June 13, 1927.

(Issued October 29, 1929)

1,733,126. SAFETY SWITCH; E. G. Johansson, Watertown, Mass. App. filed April 2, 1926.

1,733,129. BRUSH ADJUSTING DEVICE FOR GENERATORS; D. A. MacGillivray, Dalkeith, Ont., Can. App. filed April 29, 1928.

1,733,145. ELECTRIC HEATER; C. A. Xardell, Utica, N. Y. App. filed March 1, 1929.

1,733,155. SAFETY SWITCH; E. G. Johansson, Boston, Mass. App. filed April 2, 1926.

1,733,159. DEVICE FOR CARRYING RADIUM OR RADIUM CONTAINING COMPOUNDS; F. I. Leach, Ryrone, N. Mex. App. filed Dec. 27, 1927.

1,733,165. SYNCHRONIZING ARRANGEMENT FOR MOVING-PICTURE PROJECTORS; D. B. Perry, Yonkers, N. Y. App. filed Nov. 21, 1925.

1,733,179. COOLING APPARATUS FOR ELECTRICAL MACHINES; A. Baumann, Baden, Switzerland. App. filed June 8, 1927.

1,733,196. ELECTRIC COUPLING; J. C. McCune, Edgewood, Pa. App. filed Feb. 24, 1927.

1,733,206. AUTOMATIC TRAIN PIPE CONNECTER; J. V. Robinson, New York, N. Y. App. filed March 8, 1920.

1,733,216. SHORT CIRCUITING DEVICE; W. J. Branson and E. M. Wright, Springfield, O. App. filed Oct. 23, 1926.

1,733,222. DUPLEX OUTLET RECEPTACLE; J. Gehring, Jersey City, N. J. App. filed May 23, 1928.

1,733,230. ELECTRIC SWITCH; W. Lindsay, Chicago, Ill. App. filed Jan. 23, 1924.

1,733,239. APPLICATOR FOR CONDUCTING ULTRA VIOLET RAYS; D. E. Roberts, Milwaukee, Wis. App. filed Jan. 31, 1929.

1,733,242. SYSTEM OF ELECTRIC PLOWING BY DIRECT TRACTION; M. Semenza, Milan and S. Mazza, M. Mazzo and L. Bolledi, Carpaneto, Italy. App. filed Dec. 19, 1927.

1,733,250. ELECTRICAL HEATING; A. H. Davis, Jr., Buffalo, N. Y. App. filed Nov. 6, 1925.

1,733,263. HEATING AND FORGING MEANS; P. R. Hoopes, Hartford, Conn. App. filed Sept. 2, 1927.

1,733,267. SWITCH; L. Kellner, Chicago, Ill. App. filed Oct. 2, 1925.

1,733,270. SYSTEM OF AIRPLANE TRANSPORTATION; J. Messer, Hempstead, N. Y. App. filed Dec. 5, 1927.

1,733,281. VARIABLE TUNING CONDENSER; H. Spongberg, Loomis, Neb. App. filed Sept. 21, 1927.

1,733,283. ELECTRIC STREET-CAR MOTOR WITH OVERHEAD CONDUCTOR AND ROLLER GEAR; K. Stekskal, Brunn, Czechoslovakia. App. filed Dec. 22, 1928.

1,733,317. SPLICE HEAD FOR ELECTRIC CABLES; A. C. Rumble, Los Angeles, Calif. App. filed April 11, 1927.

1,733,334. METHOD AND MEANS OF STORAGE BATTERY ELECTROLYTE CONTROL; D. W. Davis, Elmhurst, Ill. App. filed Oct. 28, 1927.

1,733,335. ELECTROLYTE CONTROL CARTRIGDE; D. W. Davis, Indianapolis, Ind. App. filed Dec. 14, 1927.

1,733,337. VARIABLE CONDENSER; O. C. Deutscher, Brooklyn, N. Y. App. filed July 19, 1926.

1,733,368. ELECTRIC LAMP; H. A. Douglas, Bronson, Mich. App. filed Jan. 27, 1928.

1,733,369. METERING PANEL; H. J. L. Frank, Detroit, Mich. App. filed Oct. 23, 1922.

1,733,370. FUSE CABINET; H. J. L. Frank, Detroit, Mich. App. filed Jan. 12, 1927.

1,733,397. ELECTRIC WATER HEATER; U. W. Branchaud, Holyoke, Mass. App. filed Nov. 28, 1928.

1,733,470. ELECTRIC SOCKET; H. Shapiro, Brooklyn, N. Y. App. filed Feb. 6, 1925.

1,733,475. CONDUIT AND CIRCUIT-GROUNDING FITTING; W. H. Vibber, New London, Conn. App. filed Oct. 13, 1927.

1,733,519. ELECTRIC VALVE; F. E. Summers, near Memphis, Tenn. App. filed July 23, 1927.

1,733,530. TERMINAL POST FOR ELECTRIC HEATING ELEMENTS; A. C. Dowiatt, Westville, Ill. App. filed Nov. 27, 1928.

1,733,535. THERMIONIC-TUBE SOCKET; L. W. Gillis, Alderwood Manor, Wash. App. filed Aug. 30, 1927.

1,733,543. ELECTRIC SIGNALING APPARATUS; A. Lane, Middletown, O. App. filed Nov. 11, 1926.

1,733,554. MAGNETIC DEVICE; E. L. Norton, New York, N. Y. App. filed Oct. 30, 1926.

1,733,560. AUTOMATIC BATTERY CHARGING SYSTEM; S. V. C. Scruby, Antwerp, Belgium. App. filed July 10, 1925.

1,733,567. ELECTRIC LIGHTING DEVICE; E. C. White, New York, N. Y. App. filed Aug. 14, 1926.

1,733,591. ELECTRIC-CIRCUIT CONNECTER; A. F. F. Gilson, Oradell, N. J. App. filed April 29, 1926.

1,733,592. PROCESS OF MANUFACTURE OF MAGNETIC CORES; F. J. Given, East Orange, N. J. App. filed Feb. 6, 1929.

1,733,601. SWITCH MECHANISM FOR TESTING TRANSFORMERS; A. Johansen, Brooklyn, N. Y. App. filed June 28, 1927.

1,733,613. COMBINATION HEADLIGHT; E. R. Lochman, Milwaukee, Wis. App. filed Aug. 9, 1926.

1,733,614. SUBHARMONIC FREQUENCY PRODUCER; W. A. Marrison, Orange, N. J. App. filed Aug. 20, 1927.

1,733,615. TRANSMUTATION OF VISIBLE LIGHT RAYS TO ACCOMPLISH PHYSICAL WORK; I. E. McCabe, Chicago, Ill. App. filed Sept. 7, 1926.

1,733,679. ARC RECTIFIER; P. M. G. Toulon, Puteaux, France. App. filed Dec. 6, 1927.

1,733,689. ELECTRIC CLOCK WINDING MECHANISM; Waterbury, Conn. App. filed Dec. 11, 1926.

1,733,711. VARIABLE CONDENSER; C. Zwicker, Esslingen-on-the-Neckar, Germany. App. filed July 30, 1926.

1,733,714. SAFETY DEVICE FOR LIFTING ELECTROMAGNETS; J. Bing, Eisenach, Germany. App. filed March 11, 1924.

1,733,743. SOCKET FOR ELECTRIC LAMPS; L. Ludwig, Brooklyn, N. Y. App. filed Sept. 14, 1926.

1,733,752. REFRACTORY METAL AND ITS MANUFACTURE; J. H. Ramage, Bloomfield, N. J. App. filed Oct. 28, 1922.

1,733,763. DIATHERMY APPARATUS; W. S. Werner, Covington, Ky. App. filed April 26, 1927.

1,733,795. ROD FOR USE IN ARC WELDING OR CUTTING; J. B. Green, Chicago, Ill. App. filed Feb. 10, 1927.

1,733,797. ELECTRIC-SOCKET PLUG; J. L. L. Hall, San Diego, Calif. App. filed May 26, 1926.

1,733,802. METHOD OF MOUNTING COILED FILAMENTS; J. J. Higgins, East Orange, N. J. App. filed May 12, 1924.

New Trade Literature

WELDING RODS.—Descriptive bulletin No. 3 has been issued by the Fusion Welding Corporation, Chicago, on weldite type T welding rods. Illustrations and text describe the operating technique of this equipment.

AIR FILTERS.—Bulletin No. 117, describing the Reed multi-panel air filter, has been published by the Reed Air Filter Company, Louisville, Ky. General descriptive material and detailed technical data are contained in this booklet.

HEATER CORD. — Driver-Harris Company, Harrison, N. J., has issued an interesting little booklet entitled "How to Judge Heater Cord." This pamphlet contains a wealth of valuable information.

RECTIFIERS. — General Electric Company has issued catalog GEA-1151 on mercury-arc rectifiers for railway service. Illustrations and diagrams forcefully bring out the characteristics and operating features of this product.

Foreign Trade Opportunities

Following are listed opportunities to enter foreign markets. Further information can be obtained from the Bureau of Foreign and Domestic Commerce, Washington, by mentioning the number:

Agency and purchase are sought in Cardiff, Wales (No. 42,019), for storage batteries.

Purchase is sought in Basel, Switzerland (No. 42 021), of storage batteries.

Purchase is sought in Kingston, Canada (No. 42,024), of glass battery jars.

Purchase is sought in Malmo, Sweden (No. 42,020), of storage battery separators of Port Oxford cedar.

Agency and purchase are sought in Cardiff, Wales (No. 42,019), for cables.

Agency and purchase are sought in Amsterdam, Netherlands (No. 41,935), for flashlights.

Agency is sought in Cardiff, Wales (No. 49,092), for household electrical appliances, especially vacuum cleaners.

Agency is sought in Turin, Italy (No. 42,035), for household electrical appliances, such as dishwashers, cleaners and waxing and polishing machines.

Agency is sought in Berlin, Germany (No. 42,036), for household electrical appliances (washing and ironing machines, and vacuum cleaners).

Agency or purchase is sought in Berlin, Germany (No. 42,054), for electric household and restaurant appliances.

Agency and purchase are sought in Cardiff, Wales (No. 42,019), for self contained lighting outfits.

Purchase is sought in Oporto, Portugal (No. 42,018), of electric traffic lights.

Agency is sought in Hamburg, Germany (No. 42,031), for electrical motors, armored cables and wiring supplies.

Purchase is sought in Oslo, Norway (No. 42,177), of electric single-phase motors.

Agency is sought in Dunedin, New Zealand (No. 42,032), for small single-phase fractional horsepower motors.

Agency is sought in Winnipeg, Canada (No. 42,028), for electrical unit refrigeration.

Agency is sought in Berlin, Germany (No. 42,036), for commercial and domestic refrigerators.

Agency is sought in Singapore, Straits Settlements (No. 42,033), for electric refrigerators.

Purchase is sought in Santiago, Chile (No. 41,941), of electric signs.

Agency is sought in Dunedin, New Zealand (No. 42,032), for electric toasters and other electric equipment.

Agency is sought in Buenos Aires, Argentina (No. 42,027), for electric high frequency portable tools.

Purchase is sought in Regensburg, Germany (No. 41,989), of electric washing machines.

Agency is sought in Montreal, Canada (No. 42,029), for resistance wires for electric heating appliances.

Agency and purchase are sought in Tientsin, China (No. 41,940), for X-ray and electromedical apparatus.